Chapter 5
Water Quality

Maintaining water quality in California's waterbodies is important to ensure safe drinking water and to provide recreational, environmental, industrial and agricultural beneficial uses. This chapter describes the existing water quality of the water resources within the Environmental Water Account (EWA) Program area of analysis, and discusses potential effects to water quality in response to implementation of the EWA Program.

5.1 Affected Environment/Existing Conditions

This section provides an overview of the regulatory setting associated with water quality standards, outlines the constituents of concern, identifies designated beneficial uses, and provides a description of the waterbodies with the potential to be affected by the EWA Program.

5.1.1 Area of Analysis

The area of analysis for water quality includes the waterbodies with the potential to be affected by the EWA Program, including the Sacramento, Feather, Yuba, American, Merced, and San Joaquin River systems. The Sacramento-San Joaquin Delta Region encompasses the Delta, and the Export Service Area includes Central Valley Project (CVP)/State Water Project (SWP) facilities (Figure 5-1).

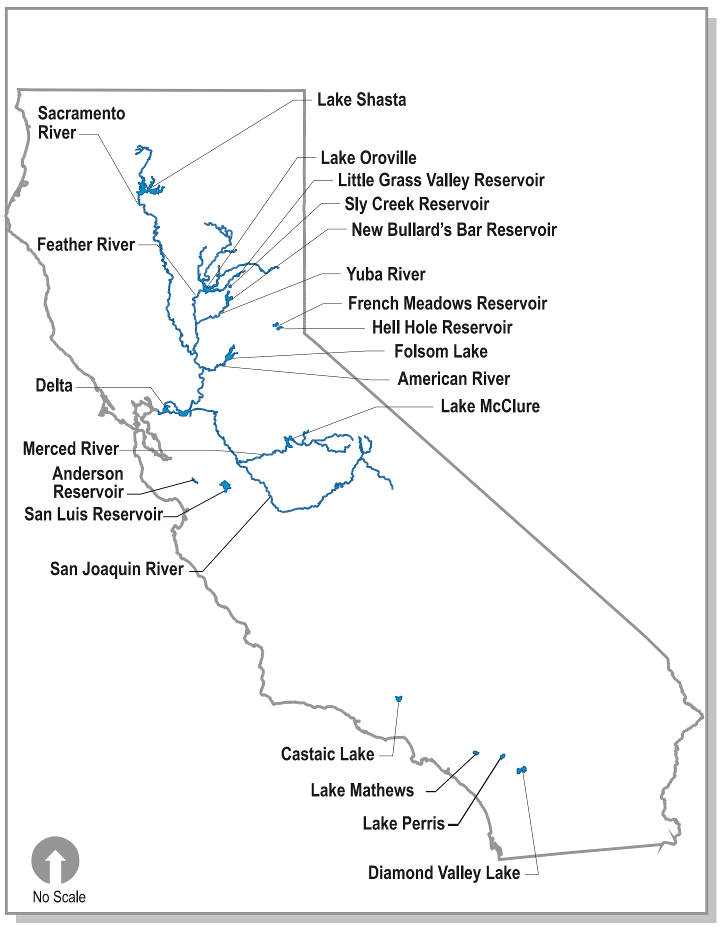


Figure 5-1
Water Quality Area of Analysis

The Sacramento River system includes Shasta Reservoir and the Sacramento River from Keswick Dam to the Delta (at approximately Chipps Island near Pittsburg). The Feather River system includes Little Grass Valley and Sly Creek Reservoirs on the South Fork Feather River; the Oroville Facilities, including Lake Oroville; and the lower Feather River extending from the Fish Barrier Dam to the confluence with the Sacramento River. The Yuba River system includes New Bullards Bar Reservoir and the lower Yuba River, extending from Englebright Dam to the confluence with the Feather River. The American River system includes French Meadows Reservoir on the Middle Fork American River and Hell Hole Reservoir on the Rubicon River; the Middle Fork American River, from Ralston Afterbay to the confluence with the North Fork American River; Folsom Reservoir; and the lower American River, extending from Nimbus Dam to the confluence with the Sacramento River. The San Joaquin River system includes Lake McClure on the Merced River; the Merced River, from Crocker-Huffman Dam to the confluence with the San Joaquin River; and the San Joaquin River from the mouth of the Merced River to Mossdale. Details regarding the facilities and waterbodies within the Upstream from the Delta Region and the water quality resources are provided in Section 5.1.5.1

The Sacramento-San Joaquin Delta Region includes the river channels and sloughs at the confluence of the Sacramento and San Joaquin rivers. Details regarding the facilities and waterbodies within the Delta Region area of analysis and the water quality resources are provided in Section 5.1.5.2. The area of analysis for the Export Service Area consists of the California Aqueduct, San Luis Reservoir, Anderson Reservoir, several SWP terminal reservoirs (Castaic Lake, Lake Perris), Lake Mathews, and Diamond Valley Lake. Details regarding the facilities and waterbodies within the Export Service Area and the water quality resources are provided in Section 5.1.5.3.

5.1.2 Regulatory Setting

5.1.2.1 Safe Drinking Water Act

The Federal Safe Drinking Water Act (SDWA) was established to protect the quality of drinking water in the United States (U.S.). This law focuses on all waters actually or potentially designated for drinking use, whether from above ground or underground sources. The SDWA authorized the Environmental Protection Agency (EPA) to establish safe standards of purity and required all owners or operators of public water systems to comply with primary (health-related) standards. State governments, which assume this power from the EPA, also encourage attainment of secondary standards (nuisance-related). Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are currently regulated by the EPA as primary and secondary maximum contaminant levels (MCLs). As directed by the SDWA amendments of 1986, the EPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants.

5.1.2.2 Surface Water Treatment Rule

The Federal Surface Water Treatment Rule (SWTR) became effective on June 19, 1989. The California Surface Water Treatment Rule (California's SWTR), which implements the Federal SWTR within the State, became effective in June 1991. The California SWTR satisfies three specific requirements of the SDWA. First, it establishes criteria for determining when filtration is required for surface waters. Second, it defines minimum levels of disinfection for surface waters. Third, it addresses *Giardia lamblia*, viruses, *Legionella*, turbidity, and heterotrophic plate count by setting a treatment technique. It is appropriate to set a treatment technique in lieu of an MCL for a contaminant when it is not technologically or economically feasible to measure that contaminant. For example, methods to accurately detect *Giardia lamblia* are very time-consuming and costly, and may not be accurate. The SWTR is based on providing treatment to achieve a minimum theoretical percent removal/inactivation of 99.9 percent (3 logs) of *Giardia lamblia* and 99.99 percent (4 logs) of viruses. Treatment required includes the use of a filtration system, unless very stringent source water quality and site-specific conditions are met. The level of treatment needed to meet the 3- and 4-log removal must be achieved by disinfection.

The disinfectants used to treat *Giardia lamblia* and viruses can react with naturally-occurring materials in the water to form unintended byproducts. These byproducts may pose health risks. Amendments to the SDWA in 1996 require EPA to develop rules to balance the risks between microbial pathogens and disinfection byproducts (DBPs). The intent is to strengthen protection against microbial contaminants, and at the same time, reduce potential health risks of DBPs. The Stage 1 Disinfectants and Disinfection Byproducts Rule and Interim Enhanced Surface Water Treatment Rule, announced in December 1998, are the first of a set of rules under the 1996 SDWA Amendments.

5.1.2.2.1 Stage 1 Disinfectants and Disinfection Byproducts Rule (D/DBPR) and Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)

While disinfectants are effective in controlling many microorganisms, they react with natural organic and inorganic matter in source water and distribution systems to form DBPs.

The Stage 1 D/DBPR updates and supersedes the 1979 regulations for total trihalomethanes (TTHMs). In addition, it is intended to reduce exposure to three disinfectants and many disinfection byproducts. The D/DBPR establishes maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for three chemical disinfectants – chlorine, chloramine and chlorine dioxide (Table 5-1). It also establishes maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for total trihalomethanes, haloacetic acids, chlorite, and bromate (Table 5-1).

Water systems that use surface water (or groundwater under the direct influence (GWUDI) of surface water) and use conventional filtration treatment are required to remove specified percentages of organic materials, measured as total organic carbon (TOC), that may react with disinfectants to form DBPs (Table 5-2). Removal is to be achieved through a treatment technique (enhanced coagulation or enhanced softening), unless the system meets alternative criteria.

Table 5-1 ***MRDLGs and MRDLs for Stage 1 Disinfectants and Disinfection Byproducts Rule***			
Disinfectant Residual	***MRDLG (mg/L)***	***MRDL (mg/L)***	***Compliance Based on***
Chlorine	4 (as Cl_2)	4.0 (as Cl_2)	Annual Average
Chloramine	4 (as Cl_2)	4.0 (as Cl_2)	Annual Average
Chlorine Dioxide	0.8 (as ClO_2)	0.8 (as ClO_2)	Daily samples
Total trihalomethanes (TTHM)[(1)]	N/A	0.080	Annual average
Chloroform	***		
Bromodichloromethane	0		
Dibromochloromethane	0.06		
Bromoform	0		
Haloacetic acids (five) (HAA5)[(2)]	N/A	0.060	Annual Average
Dichloroacetic acid	0		
Trichloroacetic acid	0.3		
Chlorite	0.8	1.0	Monthly average
Bromate	0	0.010	Annual average

N/A – Not applicable because there are individual MCLGs for TTHMs or HAAs.
(1) Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.
(2) Haloacetic acids (five) are the sum of the concentrations of the mono-, di-, and trichloroacetic acids and mono- and dibromoacetic acids.
***EPA removed the zero MCLG for chloroform from its National primary Drinking Water Regulations, effective May 30, 2000, in accordance with an order of the U.S. Court of Appeals for the District of Columbia circuit.
mg/L = milligrams/liter
Source: USEPA 1998a

Table 5-2 ***Required Removal of Total Organic Carbon by Enhanced Coagulation and Enhanced Softening for Subpart H Systems Using Conventional Treatment*** [(1)] ***Recent Required Removal of TOC***			
Source Water TOC (mg/L)	***Source Water Alkalinity (mg/L as $CaCO_3$)***		
	0-60	***>60-120***	***>120*** [(2)]
>2.0-4.0	35	25	15
>4.0-8.0	45	35	25
>8.0	50	40	30

(1) Systems meeting at least one of the alternative compliance criteria in the rule are not required to meet the removals in this table.
(2) Systems practicing softening must meet these TOC removal requirements.
Source: USEPA 1998a

Large surface water systems were required to comply with the Stage 1 D/DBPR and the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) by January 2002. Groundwater systems and small surface water systems must comply with the Stage 1 D/DBPR by January 2004.

The EPA's Science Advisory Board concluded in 1990 that exposure to microbial contaminants such as bacteria, viruses, and protozoa (e.g., *Giardia lamblia* and *Cryptosporidium*) was likely the greatest remaining health risk management challenge for drinking water suppliers. Acute health effects from exposure to microbial pathogens are documented and associated illness can range from mild to moderate cases lasting only a few days to more severe infections that can last several weeks and may result in death for those with weakened immune systems.

The primary purposes of LT1ESWTR are to improve microbial control, especially for *Cryptosporidium*, and guard against microbial risk because of the Stage 1 D/DBPR. The LT1ESWTR provisions include the following:

- MCLG of zero for *Cryptosporidium*;
- 2-log *Cryptosporidium* removal requirements for systems that filter;
- Strengthened performance standards and individual filter turbidity monitoring provisions;
- Disinfection benchmark provisions to assure continued levels of microbial protection while facilities take necessary steps to comply with new DBP standards;
- Inclusion of *Cryptosporidium* in the definition of GWUDI of surface water and additional avoidance criteria for unfiltered public water systems;
- Requirements for covers on new finished water reservoirs; and
- Sanitary surveys for all surface water and GWUDI systems regardless of size.

5.1.2.3 Federal Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act (CWA). The CWA established the basic structure for regulating discharges of pollutants into the waters of the U.S. It gave the EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The CWA also continued requirements to set water quality standards for all contaminants in surface waters. The CWA made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions (USEPA 2002c).

Section 303(d) of the 1972 CWA requires states, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The list includes waters that do not meet water quality standards for the beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water on the lists and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality (USEPA 2002c).

A TMDL is a tool for implementing water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL establishes the allowable loadings or other quantifiable parameters for a waterbody and thereby provides the basis for the establishment of water quality-based controls. These controls should provide the pollution reduction necessary for a waterbody to meet water quality standards. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation for establishment of TMDLs for each waterbody must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. Additionally, the calculation also must account for seasonal variation in water quality (USEPA 2002c).

TMDLs are intended to address all significant stressors which cause or threaten to cause waterbody use impairment, including point sources (e.g., sewage treatment plant discharges), nonpoint sources (e.g., runoff from fields, streets, range, or forest land), and naturally occurring sources (e.g., runoff from undisturbed lands). TMDLs are usually based on readily available information and studies. In some cases, complex studies or models are needed to understand how stressors are causing waterbody impairment. In many cases, simple analytical efforts provide an adequate basis for stressor assessment and implementation planning. TMDLs are developed to provide an analytical basis for planning and implementing pollution controls, land management practices, and restoration projects needed to protect water quality. States are required to include approved TMDLs and associated implementation measures in State water quality management plans or basin plans.

5.1.2.4 Porter-Cologne Act

The Porter-Cologne Act defines water quality objectives as the limits or levels of water constituents that are established for reasonable protection of beneficial uses. The Porter-Cologne Act requires the Regional Water Quality Control Board (RWQCB) to establish water quality objectives, while acknowledging that water quality may be changed to some degree without unreasonably affecting beneficial uses. Beneficial uses, together with the corresponding water quality objectives, are defined as standards, per Federal regulations. Therefore, the regional plans form the regulatory references for meeting State and Federal requirements for water quality control. Changes in water quality are only allowed if the change is consistent with the maximum beneficial use of the State, does not unreasonably affect the present or anticipated beneficial uses, and does not result in water quality less than that prescribed in the water quality control plans (RWQCBCV 1998).

5.1.2.5 Regional Water Quality Control Plans

The preparation and adoption of water quality control plans (Basin Plans) is required by the California Water Code (Section 13240) and supported by the Federal CWA. Section 303 of the CWA requires states to adopt water quality standards which "*consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses.*" According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected, water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives. State law also requires that Basin Plans conform to the policies set forth in the Water Code beginning with Section 13000 and any State policy for water quality control. Because beneficial uses, together with their corresponding water quality objectives, can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the State and Federal requirements for water quality control (40 Code Federal Regulations [CFR] 131.20). One significant difference between the State and Federal programs is that California's basin plans establish standards for groundwater in addition to surface water.

Basin Plans are adopted and amended by regional water boards under a structured process involving full public participation and State environmental review. Basin Plans and amendments thereto, do not become effective until approved by the State Water Resources Control Board (SWRCB). Regulatory provisions must be approved by the Office of Administrative Law (OAL). Adoption or revision of surface water standards is subject to the approval of the EPA.

Basin Plans complement other water quality control plans adopted by the SWRCB, such as the Water Quality Control Plans for Temperature Control and Ocean Waters. It is the intent of the SWRCB and the regional water boards to maintain the Basin Plans in an updated and readily available edition that reflects the current water quality control program. The objectives of these plans also are set to protect beneficial uses of the waterbodies including municipal uses such as drinking water. Adherence to the basin plan objectives allows for the continued use of the waterbodies to meet criteria, including drinking water treatment standards.

Several different regional water quality control plans govern waterbodies within the EWA Program area of analysis. The Central Valley Water Quality Control Plan (WQCP) covers an area including the entire Sacramento and San Joaquin river basins, involving an area bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. The area covered in this WQCP extends some 400 miles, from the California – Oregon border southward to the headwaters of the San Joaquin River. The Tulare Lake Basin WQCP comprises the drainage area of the San Joaquin Valley south of the San Joaquin River. The San Francisco Bay Regional WQCP covers all or major portions of Alameda, Contra Costa, Marin, Napa, San Mateo, San Francisco, Santa Clara, Solano, and Sonoma counties. The Los Angeles Regional WQCP encompasses all coastal drainages flowing to the Pacific Ocean between Ricon Point (on the coast of western Ventura County) and the eastern Los Angeles County line, as well as the drainages of the five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente). In addition, the Los Angeles Regional WCQP includes all coastal waters within three miles of the continental and island coastlines. The Santa Ana Regional WQCP covers the smallest area of the nine WQCPs in California (2,800 square miles) and covers southern California, roughly between Los Angeles and San Diego. In very broad terms, the Santa Ana Regional WQCP covers a group of connected inland basins and open coastal basins drained by surface streams flowing generally southwestward to the Pacific Ocean. The Pacific Ocean coast of the area covered by the Santa Ana Regional WQCP extends from just north of Laguna Beach up to Seal Beach and to the Los Angeles County line.

5.1.2.6 Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary

The San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Estuary or Estuary) is important to the natural environment and economy of California. The watershed of the Bay-Delta Estuary provides drinking water to two-thirds of California's population and water for a multitude of other urban uses. Additionally, it supplies some of California's most productive agricultural areas, both inside and outside of the Estuary. The Bay-Delta Estuary itself is one of the largest ecosystems for fish and wildlife habitat and production in the U.S. However, historical and current human activities (e.g., water development, land use, wastewater discharges, introduced species, and harvesting), exacerbated by variations in natural conditions, have degraded the beneficial uses of the Bay-Delta Estuary, as evidenced by the declines in the populations of many biological resources of the Estuary (RWQCBCV 1998).

The Bay-Delta Estuary Plan provides the component of a comprehensive management package for the protection of the Estuary's beneficial uses that involves salinity (from saltwater intrusion and agricultural drainage) and water project operations (flows and diversions), as well as a dissolved oxygen objective. This plan supplements other water quality control plans adopted by the SWRCB and RWQCBs, and State policies for water quality control adopted by the SWRCB, relevant to the Bay-Delta Estuary watershed. These other plans and policies establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors which have the potential to impair beneficial uses or cause nuisance.

5.1.2.7 State Water Resources Control Board Decision 1641

The WQCP for the Bay-Delta Estuary contains the current water quality objectives. D-1641 and Order WR 2001-05 contain the current water right requirements to implement the Bay-Delta flow dependent objectives. D-1641 includes both long-term and temporary requirements. Order WR 2001-05 requires partial implementation that will remain in effect up to 35 years. In D-1641 and in Order WR 2001-05, the SWRCB assigned responsibilities, for specified periods, to water users (including the U.S. Bureau of Reclamation (Reclamation) and the Department of Water Resources (DWR) in D-1641, and DWR in Order WR 2001-05) in the watersheds of the San Joaquin River upstream of Vernalis, the Mokelumne River, Putah Creek, Cache Creek, within the boundaries of the North Delta Water Agency, and within the Bear River watershed. These responsibilities require that the water users in these watersheds will contribute specified amounts of water to protect water quality, and that DWR and/or Reclamation will ensure that the objectives are met in the Delta (SWRCB 1997).

5.1.2.8 DWR Non-Project Water Acceptance Criteria

DWR has developed acceptance criteria to govern the water quality of non-Project water that may be conveyed through the California Aqueduct. DWR will consult with SWP contractors and the Department of Health Services (DHS) on drinking water quality issues relating to non-Project water as needed to assure the protection of SWP water quality. DWR will use a two-tier approach for accepting non-Project water pumped into the California Aqueduct. Tier 1 programs have a "no adverse impact" criteria and are tied to historical water quality levels in the California Aqueduct. Programs meeting Tier 1 criteria will be approved by DWR. Tier 2 programs have water quality levels that exceed the historical water quality levels in the California Aqueduct and have potential to cause adverse effects to State water contractors. Tier 2 programs will be referred to a State water contract facilitation group for review. The facilitation group will review the program and, if needed, make recommendations to DWR to use during consideration of the project. For additional information regarding DWR Non-Project Water Acceptance Criteria, see Section 5.2.5.3.

5.1.2.9 U.S. Bureau of Reclamation Groundwater Acceptance Criteria

Reclamation has developed a set of criteria for accepting groundwater into the Delta Mendota Canal (DMC). Different criteria are used for the portion of the DMC above check 13 at mile post 70 and below check 13. The criteria for acceptance of groundwater into the DMC above check 13 at mile post 70 are illustrated in Table 5-3. The criteria for this portion of the DMC are set for the following beneficial uses: drinking water, agriculture, and aquatic life. The criteria for acceptance of groundwater into the DMC below check 13 are illustrated in Table 5-4. The criteria for this portion of the DMC are set for protecting for the following beneficial uses: agriculture and aquatic life.

Table 5-3
Water Quality Standards For Acceptance Of Groundwater Into Delta Mendota Canal Above Check 13 (mg/L)

Constituent	Water Quality Standard	Reporting Limit
Aluminum	0.087	0.01
Antimony	0.006	0.001
Arsenic	0.01	0.002
Barium	1	0.1
Beryllium	0.004	0.001
Boron	0.8	0.1
Cadmium	0.00025*	0.0001
Chloride	106	10
Chromium	0.05	0.01
Copper	0.009*	0.001
Cyanide	0.0052	0.002
Fluoride	2	0.1
Iron	0.3	0.01
Lead	0.0025*	0.0005
Manganese	0.05	0.01
Mercury	0.00077	0.0001
Molybdenum	0.019	0.001
Nickel	0.052*	0.001
Nitrates, $N0_3$	45	10
Selenium	0.0008	0.0004
Silver	0.0032*	0.001
Sodium	185 (8 me/l)	10
Specific Conductance	700**/900*** uS/cm	1 uS/cm
Sulfate	250	20
Thallium	0.002	0.0005
TDS	450**/500***	1
Turbidity	5 NTU	0
Zinc	0.12*	0.01

* Values are based on a hardness of 100mg/L; ** Irrigation season(01Apr-31Aug); *** Drinking Water

Table 5-3 Water Quality Standards For Acceptance Of Groundwater Into Delta Mendota Canal Above Check 13 (mg/L)		
Constituent	**Water Quality Standard**	**Reporting Limit**
(01Sept-31Mar)		
Drinking Water Standards for Radioactivity (pCi/L)***		
Gross Alpha	15	3
Radium-226 + Radium-228	5	1
Tritium	20000	1000
Strontium-90	8	2
Gross Beta	50	4
Uranium	20	2
*** Analyze for Gross Alpha, if it exceeds criteria then analyze the other constituents.		
Water Quality Standards for Organic Chemicals (mg/L)		
Alachlor	0.002	0.0005
Atrazine	0.001	0.0005
Bentazon	0.018	0.001
Benzo(a)pyrene	0.0002	0.0005
Benzene	0.001	0.0005
Carbofuran	0.005	0.001
Carbon tetrachloride	0.0005	0.0005
Chlorobenzene	0.02	0.0005
Chlorpyrifos	0.000014	0.00005
Chlordane	0.000004	0.0001
2, 4-D	0.07	0.001
Dalapon	0.11	0.001
DDT	0.000001	0.00001
Diazinon	0.00005	0.0001
Dibrmochloropane	0.0002	0.0005
1,2,-Dibromo-3-chlorpropane	0.0002	0.0005
1,2-Dichlorobenzene	0.6	0.0005
1,4-Dichlorobenzene	0.005	0.001
1,1-Dichloroethane	0.005	0.001
1,1-Dichloroethylene	0.006	0.001
cis-1,1-Dichloroethylene	0.006	0.001
trans-1,2-Dichloroethylene	0.01	0.001
1,2-Dichloroethane	0.0005	0.0001
Dichlormethane	0.005	0.001
1,2-Dichloropropane	0.005	0.001
1,3-Dichloropropene	0.0005	0.0005
Di(2-ethyl)adipate	0.4	0.005
Di(2-ethylhexyl)phtalate	0.004	0.0006
Dieldrin	0.000056	0.00001
Dinoseb	0.007	0.001
Diquat	0.0005	0.0004
Endrin	0.000036	0.00001
Endothal	0.1	0.001
Ethylbenzene	0.3	0.001
Ethylene Dibromide	0.00005	0.00002
Glyphosate	0.7	0.01
Heptachlor	0.000004	0.00001
Heptachlor Epoxide	0.000004	0.00002
Hexachlrobeneze	0.001	0.0005
Hexachlorocyclopentadiene	0.001	0.0005
Lindane	0.00008	0.0002
Methoxychlor	0.00003	0.00005
MTBE	0.005	0.003
Molinate	0.013	0.001
Monochlorobenzene	0.02	0.001

Table 5-3 Water Quality Standards For Acceptance Of Groundwater Into Delta Mendota Canal Above Check 13 (mg/L)		
Constituent	**Water Quality Standard**	**Reporting Limit**
Oxamyl	0.05	0.002
Picloram	0.5	0.01
PCBs	0.000014	0.0001
Simazine	0.01	0.0005
Styrene	0.1	0.001
1,1,2,2-Tetrachlroethane	0.001	0.0005
Tetrachloroethylene (PCE)	0.005	0.0001
Thiobencarb	0.001	0.0005
Toluene	0.04	0.0005
Toxaphene	2 x10-7	0.0005
1,2,4-Trichlorobenzene	0.005	0.0005
1,1,1-Trichloroethane	0.2	0.0005
1,1,2-Trichloroethane	0.005	0.0005
Trichloroethylene (TCE)	0.005	0.0005
Freon 11	0.15	0.001
Freon 113	1.2	0.001
Vinyl chloride	0.0005	0.0001
Xylenes (total)	1.75	0.0005
2,4,5-T	0.05	0.0005

Source: B. Moore, USBR, pers. comm.

Table 5-4 Water Quality Standards For Acceptance Of Groundwater Into Delta Mendota Canal Below Check 13 (mg/L)		
Constituent	**Water Quality Standard**	**Reporting Limit**
Boron	0.8	0.1
Chromium	0.074*	0.001
Chlorpyrifos	0.000014	0.00005
Copper	0.009*	0.001
Diazinon	0.00005	0.0001
Lead	0.0025*	0.0005
Mercury	0.00077	0.00005
Molybdenum	0.019	0.001
Nickel	0.052*	0.001
Selenium	0.0008	0.0004
Specific Conductance	700** / 1,000 ***uS/cm	0
TDS	450 **/ 650***	10
Turbidity	5 NTU	0.1
Zinc	0.12*	0.001

* Values are based on a hardness of 100mg/L; ** Irrigation Season (1^{th} April - 31^{th} August); *** Non Irrigation Season (1^{th} Sept -31^{th} Mar).
Source: B. Moore, USBR, pers. comm.

5.1.3 Constituents of Concern

Various waterbodies within the area of analysis have been identified as impaired for certain constituents, as listed on the 303(d) list under the CWA. CWA Section 303(d) requires states to identify waters that do not meet applicable water quality standards after the application of certain technology-based controls. As defined in the CWA and Federal regulations, water quality standards include the designated uses of a waterbody, the adopted water quality criteria, and the State's anti-degradation policy.

As defined in the Porter-Cologne Water Quality Control Act, water quality standards are beneficial uses to be made of a waterbody, the established water quality objectives (both narrative and numeric), and the State's non-degradation policy (SWRCB Resolution No. 68-16). A further description of the CWA and the 303(d) listings is contained in Section 5.1.2.3.

Certain waterbodies in the EWA Program area of analysis are listed as water quality limited (impaired) for one or more of the constituents of concern. Table 5-5 includes the names of listed waterbodies, the constituent of concern, the potential sources for each constituent, the estimated area that is affected, and the proposed TMDL completion date. This information comes from the RWQCB plans for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Region 2), the Central Valley Basin (Region 5), the Tulare Lake Basin (Region 5), the Los Angeles Basin (Region 4), and the Santa Ana River Basin (Region 8). In addition to constituents of concern with regard to 303 (d) listed waterbodies, there are water quality constituents of concern with respect to drinking water. Water quality constituents of concern for drinking water that are relevant to the EWA Program include total trihalomethanes (chloroform, bromodichloro-methane, bromoform, and chlorodibromomethane).

Appendix G contains a description of each water quality constituent of concern including those constituents of concern for the 303 (d) listed waterbodies and the constituents of concern for drinking water. The description of each constituent includes: 1) what the constituent is and what it is commonly used for; 2) what happens to the constituent when it enters the environment; 3) how a person may be exposed to the constituent; 4) the potential health effects of exposure; 5) and the human exposure standards (EPA, Occupational Safety and Health Administration, National Institute of Occupational Safety and Health, and the Food and Drug Administration).

5.1.4 Beneficial Uses

Beneficial uses are critical to water quality management in California. State law defines beneficial uses of California's waters that may be protected against quality degradation to include (but not limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Significant points concerning the concept of beneficial uses are:

1. All water quality problems can be stated in terms of whether there is water of sufficient quantity or quality to protect or enhance beneficial uses (RWQCBCV 1998).

Table 5-5
Constituents of Concern for 303(d) Listed Waterbodies

Name	***Constituent***	***Potential Sources***	***Estimated Area Affected***	***Proposed TMDL Completion Year***
Shasta Lake	Cadmium	Resource Extraction	27335 acres	2011
	Copper	Resource Extraction	27335 acres	2011
	Zinc	Resource Extraction	27335 acres	2011
Sacramento River	Diazinon	Agriculture	274 miles	2003
	Mercury	Resource Extraction	274 miles	2005
	Unknown toxicity	Source Unknown	274 miles	After 2015
Lower Feather River	Diazinon	Agriculture/Urban Runoff/Storm Sewers	86 miles	2005
	Group A Pesticides [1]	Agriculture	86 miles	After 2015
	Mercury	Resource Extraction	86 miles	2011
	Unknown Toxicity	Source Unknown	86 miles	After 2015
Lower American River	Mercury	Resource Extraction	27 miles	After 2015
	Unknown Toxicity	Source Unknown	27 miles	After 2015
Merced River	Chlorpyrifos	Agriculture	51 miles	2005
	Diazinon	Agriculture	51 miles	2005
	Group A Pesticides [1]	Agriculture	51 miles	After 2015
San Joaquin River	Boron	Agriculture	127 miles	2003
	Chlorpyrifos	Agriculture	127 miles	2003
	DDT	Agriculture	127 miles	After 2015
	Diazinon	Agriculture	127 miles	2003
	Group A Pesticides [1]	Agriculture	127 miles	After 2015
	Mercury	Resource Extraction	127 miles	2003
	Unknown Toxicity	Source Unknown	127 miles	After 2015
Sacramento-San Joaquin Delta	Chlorpyrifos	Agriculture/Urban Runoff/ Storm Sewers	577,089 acres	2004
	DDT	Agriculture	180,568 acres	2011
	Diazinon	Agriculture/Urban Runoff/ Storm Sewers	577,089 acres	2004
	Mercury	Industrial Point Sources/ Municipal Point Sources/ Resource Extraction/ Atmospheric Deposition/ Nonpoint Sources	577,089 acres	2004
	Electrical Conductivity	Agriculture	180,568 acres	2011
	Group A Pesticides	Agriculture	180,568 acres	2011
	Organic Enrichment/Low Dissolved Oxygen	Municipal Point Sources/ Urban Runoff/Storm Sewers	1,751 acres	2004
	Unknown Toxicity	Source Unknown	1,751 acres	2011

Group A Pesticides: aldrin, dieldrin, endrin, chlordane, heptachlor, heptachlor expoxid, hexachlorocyclohexane, endosulfan, and toxaphehe
Sources: RWQCBCV 1998, RWQCBSA 1995, RWQCBLA 1994, RWQCBSFB 1995, SWRCB 2003.

2. Beneficial uses do not include all of the reasonable uses of water. For example, disposal of wastewaters is not included as a beneficial use. This is not to say that disposal of wastewaters is a prohibited use of waters of the State; it is merely a use, which cannot be satisfied to the detriment of beneficial uses. Similarly, the use of water for the dilution of salts is not a beneficial use although it may, in some cases, be a reasonable and desirable use of water (RWQCBCV 1998).

3. The protection and enhancement of beneficial uses require that certain quality and quantity objectives be met for surface and ground waters (RWQCBCV 1998).

4. Fish, plants, and other wildlife, as well as humans, use water beneficially.

The beneficial uses designated for waters within the EWA Program area of analysis are presented in Table 5-6 (Upstream from the Delta Region), Table 5-7 (Sacramento-San Joaquin Delta Region), and Table 5-8 (Export Service Area). Appendix G contains of beneficial use definitions. The beneficial uses of any specifically identified waterbody generally apply to its tributary streams. In some cases, a beneficial use may not be applicable to the entire body of water. In these cases the RWQCB's judgment is applied. Waterbodies within the basins that do not have beneficial uses designated are assigned MUN designations in accordance with the provisions of SWRCB Resolution No. 88-63. These MUN designations in no way affect the presence or absence of other beneficial uses in these waterbodies.

Table 5-6
Beneficial Uses of Waterbodies in the Upstream from the Delta Region

Beneficial Use Designation	***Lake Shasta***	***Sacramento River***	***Little Grass Valley and Sly Creek***	***Lake Oroville***	***Lower Feather River***	***New Bullards Bar Reservoir***	***Lower Yuba River***	***French Meadows Reservoir***	***Hell Hole Reservoir***	***Middle Fork American River***	***Folsom Reservoir***	***Lower American River***	***Lake McClure***	***Merced River***	***San Joaquin River***
Municipal and Domestic Supply	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	
Irrigation Watering	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stock Watering		✓				✓	✓	✓	✓	✓				✓	✓
Industrial Process Supply														✓	✓
Industrial Service Supply		✓										✓		✓	
Hydropower Generation	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water Contact Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Canoeing and Rafting[1]		✓			✓	✓	✓	✓	✓	✓		✓		✓	✓
Non-contact Water Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Warm Freshwater Habitat[2]	✓	✓	✓	✓	✓		✓				✓	✓	✓	✓	✓
Cold Freshwater Habitat[2]	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Warm[3] and Cold[4] Water Migration Areas		✓			✓		✓					✓		✓	✓
Warm[3] and Cold[4] Water Spawning Habitat	✓	✓	✓	✓	✓		✓					✓		✓	✓
Warm Water Spawning Habitat[3]	✓	✓		✓	✓		✓				✓	✓		✓	✓
Cold Water Spawning Habitat[4]	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓		✓	
Navigation		✓													
Wildlife Habitat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: RWQCBCV 1998
1. Shown for streams and rivers only with the implication that certain flows are required for this beneficial use.
2. Resident does not include anadromous. Any segments with both COLD and WARM beneficial use designations will be considered COLD waterbodies for the application of water quality objectives.
3. Striped bass, sturgeon, and shad.
4. Salmon and steelhead.

Table 5-7
Beneficial Uses of Waterbodies in the Sacramento-San Joaquin Delta Region

Beneficial Use Designation	Delta Inland Surface Waters	San Francisco Bay Estuary	Delta Coastal Waters
Municipal and Domestic Supply	✓	✓	
Irrigation Watering	✓	✓	
Stock Watering			
Industrial Process	✓	✓	✓
Service Supply			
Groundwater Recharge	✓	✓	
Power Generation			
Water Contact Recreation	✓	✓	✓
Non-contact Water Recreation	✓	✓	✓
Warm Freshwater Habitat	✓	✓	
Cold Freshwater Habitat	✓	✓	
Fish Migration	✓	✓	
Fish Spawning Habitat	✓		
Navigation		✓	✓
Wildlife Habitat	✓	✓	
Estuarine Habitat		✓	
Shellfish Harvesting			✓
Ocean, Commercial and Sport Fishing			✓
Preservation of Rare and Endangered Species			✓
Marine Habitat			✓

Source: RWQCBSFB 1995

Table 5-8
Beneficial Uses of Waterbodies in the Export Service Area

Beneficial Use Designation	California Aqueduct	San Luis Reservoir	Castaic Lake	Lake Perris
Municipal and Domestic Supply	✓	✓	✓	✓
Agricultural Watering	✓	✓	✓	✓
Irrigation Watering	✓	✓		
Stock Watering	✓	✓		
Industrial Process	✓		✓	✓
Service Supply	✓	✓	✓	✓
Groundwater Recharge			✓	✓
Power Generation	✓	✓	✓	
Water Contact Recreation	✓	✓	✓	✓
Non-contact Water Recreation	✓	✓	✓	✓
Cold Freshwater Habitat			✓	✓
Warm Freshwater Habitat		✓	✓	✓
Fish Migration				
Warm Water Spawning Habitat			✓	
Cold Water Spawning Habitat			✓	
Navigation				
Wildlife Habitat	✓	✓	✓	✓
Estuarine Habitat				
Shellfish Harvesting				
Ocean, Commercial and Sport Fishing				
Preservation of Rare and Endangered Species			✓	
Marine Habitat				

Source: RWQCBSA 1995, RWQCBLA 1994, RWQCBCV 1998

5.1.5 Environmental Settings

The general water quality for each of the waterbodies evaluated in the area of analysis is described in the following sections. Environmental setting information varies by geographic area because individual waterbodies have different water quality concerns. For waterbodies in the Upstream from the Delta Region, a description of the location of each waterbody is provided and land use around each of the waterbodies is briefly described. Land use is described for each waterbody because it can affect the quality of runoff that the waterbody receives and therefore, the water quality of the waterbody itself. In addition, where available, data describing general water quality parameters including pH, turbidity, dissolved oxygen, TOC, total suspended solids, nitrogen, phosphorus, and electrical conductivity or total dissolved solids are presented to provide information regarding the general water quality within each waterbody. Environmental settings information in the Delta Region and in the Export Service Area is more extensive due to the greater potential for the EWA Program to affect water quality in these areas. General background describing water quality in the Delta is provided, followed by a detailed discussion of salinity, organic carbon, and bromide, which are constituents of concern with respect to drinking water. Settings information for reservoirs in the Export Service Area focus on water quality concerns such as algal growth and also includes data describing the general water quality parameters listed above where such data is available.

5.1.5.1 Upstream from the Delta Region

5.1.5.1.1 Sacramento River Area of Analysis

The Sacramento River basin covers nearly 70,000 square kilometers (km^2) in the north-central part of California (USGS 2002a). The basin includes all or parts of six physiographic provinces – the Great Basin, the Middle Cascade Mountains, the Sierra Nevada, the Klamath Mountains, the Sacramento Valley, and the Coast Ranges. Land cover in the mountainous parts of the basin is primarily forest, except in parts of the Coast Ranges and the Great Basin where land cover is forestland and rangeland. Previous mining activities in the Klamath Mountains have resulted in acid mine drainage into Keswick Reservoir, along with the associated metals cadmium, copper, and zinc. Mercury, from previous mining activities in the Coast Ranges, enters the Sacramento Valley through Cache Creek and Putah Creek, which drain into the Yolo Bypass. The Yolo Bypass reenters the lower Sacramento River through Cache Slough and during low-flow and storm water runoff conditions, mercury can be transported downstream to receiving waters.

<u>Lake Shasta</u>
Lake Shasta is located on the upper Sacramento River in the Shasta Trinity National Forest and is used as a storage facility for water from snowmelt in the upper Sierra Nevada Mountains.

General water quality parameters for Lake Shasta are summarized in Table 5-9. Water quality in Lake Shasta generally is considered to be of good quality.

Table 5-9 Water Quality Parameters Sampled at Lake Shasta			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH[1] (standard units)	7.2	8.1	7.5
Turbidity[2] (NTU)	0.0	1.0	0.52
Dissolved Oxygen[2] (mg/L)	8.2	11.5	9.94
Total Organic Carbon[1] (mg/L)	N/A	N/A	N/A
Nitrogen[1] (mg/L)	0.01	0.54	0.093
Phosphorus[1] (mg/L)	0.0	0.129	0.030
Electrical Conductivity[1] (µS/cm)	105	131	116.9

Sources: [1-]USGS 1980; [2-]CDEC 2002
N/A – not available

<u>Sacramento River</u>

The Sacramento River is the largest river in California, providing water for municipal, agricultural, recreation, and environmental purposes throughout northern and southern California. Water users that have contracts with Reclamation to take delivery of CVP water from the Sacramento River system receive Sacramento River contractor water. General water quality data reported for several locations along the Sacramento River are presented below in the following sections and in Tables 5-10 through 5-12.

Sacramento River Above Bend Bridge Near Red Bluff

The Sacramento River sampling site above Bend Bridge near Red Bluff is located 83.7 km downstream of Shasta Dam. Streamflow is greatly influenced by managed releases from Lake Shasta and, during the rainy season, by storm water runoff. There are no artificial levees at this location; therefore, the stream channel is in a natural state. The drainage basin area at this site is 23,569 km^2 and includes parts or all of the Great Basin, Middle Cascade Mountains, Klamath Mountains, Coast Ranges, and Sacramento Valley physiographic provinces. Land cover in the area is mainly forestland; cropland, pasture and rangeland cover most of the remaining land area. Mining operations take place or have taken place in the Klamath Mountains and water quality effects from mining activities are likely to be detected at this location (USGS 2002a). Over a three-year period (1996-1998); 27 samples were taken. The data in Table 5-10 present the general water quality parameters.

Table 5-10 Water Quality Parameters Sampled at Sacramento River Above Bend Bridge Near Red Bluff			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	7.4	8.1	7.8
Turbidity (mg/L)	3	355	38.8
Dissolved Oxygen (mg/L)	8.2	12.1	10.7
Total Organic Carbon (mg/L) [1]	0.9	3.2	1.55
Nitrogen (mg/L) [1]	0.07	0.25	0.12
Phosphorus (mg/L) [1]	0.01	0.03	0.02
Electrical Conductivity[1] (µS/cm)	104	145	116.7

Sources: USGS 2002f, [1] USGS 2002e

Sacramento River at Freeport

The Sacramento River sampling site at Freeport is the furthest downstream monitoring site reported on the Sacramento River. Therefore, water-quality samples at this site integrate the effects of most land uses or land covers and physiographic provinces of the entire watershed. Forestland is the largest land use cover (USGS 2002a). The data in Table 5-11 present the general water quality parameters for samples collected over a three-year period (1996-1998); 31 samples were taken.

Table 5-11
Water Quality Parameters Sampled at Sacramento River at Freeport

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7	8.1	7.7
Turbidity (mg/L)	12	368	53.9
Dissolved Oxygen (mg/L)	6.5	12.2	9.7
Total Organic Carbon (mg/L)[1]	0.3	3.7	1.7
Nitrogen (mg/L)[1]	0.058	0.257	0.13
Phosphorus (mg/L)[1]	0.010	0.04	0.017
Electrical Conductivity[1] (µS/cm)	51	166	124.3

Sources: USGS 2002h; [1]USGS 2002g

For information regarding environmental settings for the Sacramento River at Greenes Landing/Hood, please see Section 5.1.5.2. Information regarding the Sacramento River's contribution to salinity, bromide and organic carbon loading to the Delta can be found in Section 5.1.5.2.1.

5.1.5.1.2 Feather River Area of Analysis

The Feather River is a large tributary to the Sacramento River. Flow in the lower Feather River is controlled mainly by releases from Lake Oroville, the second largest reservoir within the Sacramento River basin, and by flow from the Yuba River, a major tributary. Forestland is the major (about 78 percent of total) land use or land cover for the Feather River basin. Gold mining also was an important land use in the Sierra Nevada foothills that are part of the Feather River basin. The Yuba and the Bear rivers both flow into the lower Feather River. Both the Yuba River and the Bear River basins have been affected by past gold mining and contribute mercury to the lower Feather and Sacramento rivers (May et. al. 2000).

<u>Little Grass Valley and Sly Creek Reservoirs</u>
Little Grass Valley and Sly Creek reservoirs are upstream of Lake Oroville on the Feather River. Almost the entire surrounding watershed consists of the Plumas National Forest and managed forest lands; less than five percent of the watershed consists of rural residential and commercial areas. Evidence from a 1995 Watershed Sanitary Survey conducted on the watershed and current analytical data identify forest management practices and historic and active mining operations as potential sources of contaminants to the watershed. However, currently these waterbodies are not included on the CWA 303(d) list. Land uses surrounding the reservoirs are low impact, consisting of campgrounds, hiking trails, and access roads.

Both of these reservoirs are on the upper South Fork of the Feather River and receive their water from this source. Because data detailing concentrations of water quality constituents in Little Grass Valley and Sly Creek reservoirs were not available, water quality data from the South Fork of the Feather River downstream of both reservoirs is presented below. The minimum and maximum levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity or total dissolved solids that currently exist in the South Fork of the Feather River at Mining Ranch Canal are presented in Table 5-12.

Table 5-12
Water Quality Parameters Sampled on the South Fork Feather River at Miners Ranch Canal

Water Quality Parameter	Minimum	Maximum
pH (standard units)	7	7.3
Turbidity (mg/L)	0.5	14
Dissolved Oxygen (mg/L)	9.4	12.9
Total Organic Carbon (mg/L)	N/A	N/A
Nitrogen (mg/L)	less than 0.1	0.1
Phosphorus (mg/L)	less than 0.1	0.1
Electrical Conductivity (µS/cm)	34	54

Source: DWR 2001c
N/A – not available

Lake Oroville

Lake Oroville is primarily used for water supply, power generation, flood control, fish and wildlife enhancement, and recreational purposes (DWR 2001c). Water quality in Lake Oroville is influenced by tributary streams, of which the Middle, North, and South forks of the Feather River contribute the bulk of the inflow to the reservoir. The minimum and maximum levels of general water quality parameters: pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity or total dissolved solids in Lake Oroville are presented in Table 5-13. All of the data were sampled near the dam at Lake Oroville and samples were taken bimonthly from January 1992 to May 1997.

Table 5-13
Water Quality Parameters Sampled at Lake Oroville

Water Quality Parameter	Minimum	Maximum
pH (standard units)	6.8	7.4
Turbidity (mg/L)	0.58	25
Dissolved Oxygen (mg/L)	7.8	12
Total Organic Carbon (mg/L)	N/A	N/A
Nitrogen (mg/L)	0.01	0.13
Phosphorus (mg/L)	0.01	0.57
Electrical Conductivity (µS/cm)	31	85

Source: DWR 2001c
N/A – not available

Lower Feather River

The minimum, maximum, and average levels of water quality constituents for the lower Feather River are presented in Table 5-14. All of the data were sampled on the Feather River near Nicolaus, California over a three-year period (1996-1998); 27 samples were taken.

Table 5-14 Water Quality Parameters Sampled on the Feather River Near Nicolaus			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	7.4	8.4	7.7
Turbidity (mg/L)	8	123	36.5
Dissolved Oxygen (mg/L)	9	15.7	10.1
Total Organic Carbon (mg/L)[1]	1.2	3.2	1.7
Nitrogen (mg/L)[1]	0.05	1.63	0.15
Phosphorus (mg/L) [1]	0.010	0.02	0.013
Electrical Conductivity (μS/cm)	56	122	84.7

Sources: USGS 2002a, [1] USGS 2002b

5.1.5.1.3 *Yuba River Area of Analysis*

The Yuba River is the largest tributary to the Feather River. Forestland is the primary land use and land cover for the Yuba River basin, comprising about 85 percent of the land cover (USGS 2002a). The forestland in the Yuba River Basin is located in the foothills of the Sierra Nevada, which also experienced a substantial amount of gold mining, including placer and hard rock mines. Mercury was used in the basin to recover gold from both placer deposits and ore-bearing minerals. Residual mercury from those operations has been detected in invertebrate and fish communities nearby and downstream from the gold mining operations (Slotton *et al.* 1997; May *et al*. 2000). According to Slotton *et al*., (1997), reservoirs constructed just downstream from the gold mining operations act as a sink for mercury. However, mercury transported to the lower Yuba drainage prior to reservoir construction probably is still in the streambed sediment.

<u>New Bullards Bar Reservoir</u>
New Bullards Bar Reservoir on the North Yuba River is approximately 21 miles north of Nevada City, in Yuba County. The average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity or total dissolved solids for New Bullards Bar Reservoir are presented in Table 5-15. All of the data were collected on the North Fork of the Yuba River near New Bullards Bar Reservoir. The total organic carbon, nitrogen, and phosphorus samples all were taken during an eight-month period during 2001 and a total of seven samples were taken for each. The other parameters were sampled over a 12-month period during the course of one year and a total of seven samples were taken for each.

Table 5-15 Water Quality Parameters Sampled on the North Yuba River Near New Bullards Bar Reservoir			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	7.0	8.1	7.2
Turbidity (mg/L)	0	44.7	11.5
Dissolved Oxygen (mg/L)	8.3	12.3	9.9
Total Organic Carbon (mg/L)[1]	0.59	2.6	1.3
Nitrogen (mg/L) [1]	0.025	0.050	0.04
Phosphorus (mg/L)[1]	0.004	0.006	0.011
Electrical Conductivity (μS/cm)	20	30	23.8

Sources: SYRCL 2002; [1]USGS 2001

Lower Yuba River

The general water quality of the lower Yuba River is good and has improved in recent decades due to controls on hydraulic and dredge mining operations, and the establishment of minimum instream flows (Beak 1989 *in* SWRI 2000). Dissolved oxygen concentrations, total dissolved solids, pH, hardness, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater biota.

The minimum, maximum, and average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity for the lower Yuba River are presented in Table 5-16. All of the data were collected on the Yuba River near Marysville over a three-year period (1996-1998); 27 samples were taken.

Table 5-16
Water Quality Parameters Sampled on the Yuba River Near Marysville

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7	7.8	7.5
Turbidity (mg/L)	1	153	29.9
Dissolved Oxygen (mg/L)	8	12.4	11.4
Total Organic Carbon (mg/L)[1]	0.7	2.4	1.1
Nitrogen (mg/L)[1]	0.05	0.137	0.07
Phosphorus (mg/L)[1]	0.01	0.02	0.01
Electrical Conductivity (µS/cm)	44	105	72.8

Sources: USGS 2002c ; [1]USGS 2002d

5.1.5.1.4 *American River Area of Analysis*

The American River is a large tributary to the Sacramento River. Forestland constitutes the greatest percentage of land use or land cover (77 percent). Gold mining also occurred within the American River basin. Placer gold was first discovered in the American River in 1848, triggering the exploration and mining of gold that followed. The lower American River is listed as an impaired waterbody owing to mercury lost during gold recovery.

French Meadows Reservoir

French Meadows Reservoir is on the Middle Fork of the American River in Placer County. Water quality in French Meadows Reservoir is generally considered to be of good quality. The average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity for French Meadows Reservoir are presented in Table 5-17.

Table 5-17
Water Quality Parameters Sampled at French Meadows Reservoir

Water Quality Parameter	Average
pH (standard units)	7.31
Turbidity (mg/L)	0.4
Dissolved Oxygen (mg/L)[1]	9.60
Total Organic Carbon (mg/L)	1.24
Nitrogen (mg/L) [1]	0.11
Phosphorus (mg/L)	1.1
Electrical Conductivity (µS/cm)	25.60

Sources: Storet 1985; [1] Storet 1981

Hell Hole Reservoir

Hell Hole Reservoir, in the El Dorado National Forest, receives flows from the Rubicon River, a tributary of the Middle Fork American River. Water quality in Hell Hole Reservoir is generally considered to be of good quality. The average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity within Hell Hole Reservoir are presented in Table 5-18.

Table 5-18
Water Quality Parameters Sampled at Hell Hole Reservoir

Water Quality Parameter	Average
pH (standard units) [1]	7.10
Turbidity (mg/L)	N/A
Dissolved Oxygen (mg/L)	9.60
Total Organic Carbon (mg/L)	N/A
Nitrogen (mg/L)	0.11
Phosphorus (mg/L)	0.01
Electrical Conductivity (µS/cm) a	26.00

Sources: Storet 1985; [1]Storet 1969
N/A – not available

Middle Fork American River

Water quality in the Middle Fork American River is generally considered to be of good quality. The average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity for the Middle Fork American River are presented in Table 5-19.

Table 5-19
Water Quality Parameters Sampled on the Middle Fork American River

Water Quality Parameter	Average
pH (standard units)	7.50
Turbidity (mg/L)	0.40
Dissolved Oxygen (mg/L)	9.60
Total Organic Carbon (mg/L)	N/A
Nitrogen (mg/L)	0.11
Phosphorus (mg/L)	0.01
Electrical Conductivity (µS/cm)	49.00

Source: Storet 1981
N/A – not available

Folsom Reservoir

Folsom Reservoir is about 25 miles east of the city of Sacramento on the American River. Folsom Reservoir regulates runoff from about 1,875 square miles of drainage area. The average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and total dissolved solids within Folsom Reservoir are presented in Table 5-20.

Table 5-20 Water Quality Parameters Sampled at Folsom Reservoir			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
PH (standard units)	5.82	8.46	7.09
Turbidity (mg/L)	1	68	1.2
Dissolved Oxygen (mg/L)	7.04	13.6	10.3
Total Organic Carbon (mg/L)	2	3.5	N/A
Nitrogen (mg/L)	N/A	N/A	N/A
Phosphorus (mg/L)	N/A	N/A	N/A
Electric Conductivity (µS/cm)	18.5	123	52.2

Source: Larry Walker Associates 1999

Lower American River

The lower American River is a tributary to the Sacramento River. Water quality in the lower American River is generally considered to be of good quality. The average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and total dissolved solids for the lower American River are presented in Table 5-21.

Table 5-21 Water Quality Parameters Sampled on the Lower American River			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	7.0	7.7	7.4
Turbidity (mg/L)	2	116	13.9
Dissolved Oxygen (mg/L)	8.2	12.8	5.1
Total Organic Carbon (mg/L) [1]	1.1	6.4	1.7
Nitrogen (mg/L)[1]	0.05	0.2	0.08
Phosphorus (mg/L) [1]	0.01	0.03	0.012
Total Dissolved Solids (mg/L)	40	68	51.1

Sources: USGS 2002i; [1] USGS 2002j

5.1.5.1.5 Merced River Area of Analysis

The Merced River is a tributary to the San Joaquin River; its watershed extends into the Sierra Nevada Mountains. Historical land uses within the basin include aggregate and mineral mining operations that eroded adjacent lands. Currently, much of the land within the basin is used for agriculture and the lower Merced River is known to receive a high volume of agricultural field inflows.

Lake McClure

Lake McClure is on the Merced River. No water quality data was available for Lake McClure. The average levels of pH, turbidity, dissolved oxygen, total organic carbon, nitrogen, phosphorus, and electrical conductivity presented in Table 5-22 were collected on the Merced River, which is just above Lake McClure. The samples were taken over a 22-year period from 1972 through 1990. The numbers of samples taken for each parameter are shown in the table.

Table 5-22 **Water Quality Parameters Sampled on the Merced River Near Briceberg**	
Water Quality Parameter	**Average**
pH (standard units)	7.2 (59 samples)
Turbidity (mg/L)	2 (7 samples)
Dissolved Oxygen (mg/L)	10.4 (40 samples)
Total Organic Carbon (mg/L)	1.6 (7 samples)
Nitrogen (mg/L)	0.16 (25 samples)
Phosphorus (mg/L)	0.02 (34 samples)
Electrical Conductivity (µS/cm)	43 (58 samples)

Source: Kratzer and Shelton 1998

Merced River

The minimum, maximum, and average levels of water quality constituents for the Merced River are presented in Table 5-23, as available. All the samples were taken on the Merced River near Stevinson (near the mouth of the Merced River) over a 22-year period from 1972 through 1990. The number of samples taken for each parameter is shown in the tables.

Table 5-23 **Water Quality Parameters Sampled on the Merced River Near Stevinson**			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	N/A	N/A	7.6 (60 samples)
Turbidity (mg/L)	7	30	21 (50 samples)
Dissolved Oxygen (mg/L)	N/A	N/A	8.4 (56 samples)
Total Organic Carbon (mg/L)	N/A	N/A	2.9 (42 samples)
Nitrogen (mg/L)	2.4	0.8	1.9 (57 samples)
Phosphorus (mg/L)	0.15	0.04	0.08 (57 samples)
Electrical Conductivity (µS/cm)	N/A	N/A	189 (60 samples)

Source: Kratzer and Shelton 1998
N/A – not available

5.1.5.1.6 San Joaquin River Area of Analysis

The primary land use in the valley area around the San Joaquin River is agricultural. Nutrient and suspended sediment concentrations in surface water are highest along the west side of the river. Most suspended sediment in the river comes from a variety of sources, including: agricultural drainage, wastewater treatment plants, and runoff from dairies. Flow-adjusted nitrate concentrations have increased steadily in the lower San Joaquin River since the 1950s (Kratzer and Shelton 1998). This can be attributed to many factors, including increases in subsurface agricultural drainage, fertilizer application, wastewater treatment plant effluent, and runoff from dairies. Since 1970, this increase has been due primarily to increases in mostly native soil nitrogen in sub-surface agricultural drainage. Flow-adjusted ammonia concentrations decreased during the 1980s and these decreases are probably related to improved regulation of domestic and dairy wastes (Kratzer and Shelton 1998).

The minimum, maximum, and average levels of water quality constituents for the San Joaquin River are presented in Tables 5-24 and 5-25. The number of samples taken for each parameter is presented in the tables. Samples were taken on the San Joaquin River near Newman (near the confluence of the San Joaquin and Merced rivers) over a 22-year period from 1972 through 1990 (Table 5-24).

Table 5-24 Water Quality Parameters Sampled on the San Joaquin River Near Newman			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	N/A	N/A	8.0 (57 samples)
Turbidity (mg/L)	35	500	103 (45 samples)
Dissolved Oxygen (mg/L)	N/A	N/A	9.2 (31 samples)
Total Organic Carbon (mg/L)	N/A	N/A	6.8 (41 samples)
Nitrogen (mg/L)	1.4	4.8	3.1 (53 samples)
Phosphorus (mg/L)	0.14	0.5	0.26 (54 samples)
Electrical Conductivity (μS/cm)	N/A	N/A	1,190 (57 samples)

Source: Kratzer and Shelton 1998.
N/A – not available

Samples taken on the San Joaquin River near Vernalis are presented in Table 5-25.

Table 5-25 Water Quality Parameters Sampled on the San Joaquin River Near Vernalis			
Water Quality Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	7.0	9.0	8.2
Turbidity (mg/L) [1]	45	180	77 (3,503 samples)
Dissolved Oxygen (mg/L)	7.3	N/A 12.9	9.6
Total Organic Carbon (mg/L)	7.0	17	10.1
Nitrogen (mg/L) [1]	1.0	3.2	2.2 (501 samples)
Phosphorus (mg/L) [1]	0.14	0.38	0.24 (480 samples)
Electrical conductivity (μS/cm)	N/A	N/A	320

Source: USGS 2003 (samples taken monthly from 1995-2000); [1]Kratzer and Shelton 1998 (samples taken 22-year period from 1972 – 1990).
N/A – not available

For information regarding environmental settings for the portion of the San Joaquin River at Vernalis/Mossdale, please see 5.1.5.2 Information regarding the San Joaquin River's contribution to salinity, bromide and organic carbon loading to the Delta can be found in Section 5.1.5.2.1.

5.1.5.2 Sacramento-San Joaquin Delta Region

The Sacramento-San Joaquin Delta (Delta) Region forms the lowest part of the Central Valley, bordering and lying between the Sacramento and San Joaquin rivers, and extending from the confluence of these rivers inland as far as Sacramento and Stockton. The Delta is an important agricultural area, with more than 75 percent of the region's total production used for corn, grain, hay, and pasture. Although much of the Delta is used for agriculture, the land also provides habitat for wildlife. Many agricultural fields are flooded in the winter, providing foraging and roosting sites for migratory waterfowl. In addition to lands that are used seasonally, the California Department of Fish and Game (CDFG) manages thousands of acres specifically for wildlife including Lower Sherman Island and White Slough Wildlife Areas, Woodbridge Ecological Reserve, and Palm Tract Conservation Easement (SWRCB 1997).

Because water quality in the Delta Region is governed in part by Delta hydrodynamics, which are highly complex, the following paragraphs provide a brief description of the hydrodynamic conditions in the Delta. This description provides proper context for understanding potential effects to water quality that could result from implementation of the EWA Program. A discussion of general water quality in the Delta and water quality constituents of concern with respect to drinking water is provided following the description of Delta hydrodynamics.

The principal factors affecting Delta hydrodynamic conditions are: 1) river inflow from the San Joaquin and Sacramento River systems, 2) daily tidal inflow and outflow through the San Francisco Bay, and 3) export pumping from the south Delta through the Harvey O. Banks Pumping Plant and Tracy Pumping Plant. Because tidal inflows are approximately equivalent to tidal outflows during each daily tidal cycle, tributary inflows and export pumping are the principal variables that define the range of hydrodynamic conditions in the Delta. Freshwater flows into the Delta from three major sources: the Sacramento River, the San Joaquin River, and the eastside streams. The Sacramento River contributes about 77 percent of the freshwater flows, the San Joaquin River contributes roughly 15 percent, and streams on the east side provide the remainder. On average, 10 percent of the Delta inflow is withdrawn for local use, 30 percent is withdrawn for export by the CVP and SWP, 20 percent is required for salinity control, and the remaining 40 percent provides outflow to the San Francisco Bay ecosystem in excess of minimum identified requirements (CALFED 2000a).

Flow that enters the Delta via the Sacramento River flows by various routes to the export pumps in the southern Delta. Some of this flow is drawn to the SWP and CVP pumps through interior Delta channels, facilitated by the CVP's Delta Cross Channel. Water that does not travel into the Central Delta continues towards the San Francisco Bay. Under certain conditions, additional Sacramento River waters flow into the Central and South Delta. The Sacramento River waters flow through Threemile Slough, around the western end of Sherman Island and up the San Joaquin River towards the export pumps. When freshwater outflow is relatively low, water with a higher salt concentration enters the Central and South Delta as tidal inflow from the San Francisco Bay. When SWP and CVP exports cause flow from the Sacramento River to move toward the pumps, then "reverse flow" occurs in the lower San Joaquin River. Prolonged reverse flow has the potential to adversely affect water quality in the Delta and at the export pumps by increasing salinity (SWRCB 1997, Entrix 1996, CALFED 2002a).

5.1.5.2.1 Delta Drinking Water Quality Concerns

Appendix G describes the constituents of concern in the Delta. The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon. Water quality constituents that are of specific concern with respect to drinking water, including salinity, bromide, and organic carbon, are described below and further detailed in Appendix G. Table 5-26 presents water quality data for salinity, bromide, and organic carbon at selected stations within the Delta.

Salinity

Salinity is measures using a variety of methods. Salinity is a measure of the mass fraction of salts, measured in parts per thousand (ppt). Total dissolved solids (TDS) is a measure of the concentration of salt, as measured in mg/L (DWR 2001b). Electrical conductivity is a measure of the ability of a solution to carry a current and depends on the total concentration of ionized substances dissolved in the water. Because electrical conductivity (EC) of water generally changes proportionately to changes in dissolved salt concentrations, EC is a convenient surrogate measure for TDS.

Table 5-26 illustrates that mean TDS concentrations are highest in the west Delta and the south Delta channels which are affected by the San Joaquin River (CALFED 2000a). Salinity problems in the western Delta result primarily from the incursion of saline water from the San Francisco Bay system, and incursion of saline water to the western Delta may affect municipal and industrial uses (SWRCB 1997). The extent of seawater intrusion into the Delta is a function of daily tidal fluctuations, the freshwater inflow to the Delta from the Sacramento and San Joaquin rivers, the rate of export at the SWP and CVP intake pumps, and the operation of various control structures such as the Delta Cross-Channel Gates and Suisun Marsh Salinity Control System (DWR 2001b). In the southern Delta, salinity is largely associated with the high concentrations of salts carried by the San Joaquin River into the Delta (SWRCB 1997). The high mean concentration of TDS in the San Joaquin River at Vernalis reflects the accumulation of salts in agricultural soils and the effects of recirculation of salts via the Delta Mendota Canal (CALFED 2000a). Locations in the north portion of the Delta at Barker Slough, which is not substantially affected by seawater intrusion, and in the Sacramento River at Greene's Landing have lower mean concentrations of TDS. A similar pattern is seen using mean EC levels as a surrogate for TDS.

Table 5-26
Water Quality Data for Selected Stations Within the Delta

Location	Mean TDS (mg/L)	Mean Electrical Conductivity (μS/cm)	Mean Bromide, Dissolved (mg/L)	Mean DOC (mg/L)	Mean Chloride, Dissolved (mg/L)
Sacramento River at Greene's Landing	100	160	0.018	2.5	6.8
North Bay Aqueduct at Barker Slough	192	332	0.015	5.3	26
SWP Clifton Court Forebay	286	476	0.269	4.0	77
CVP Banks Pumping Plant	258	482	0.269	3.7	81
Contra Costa Intake at Rock Slough	305	553	0.455	3.4	109
San Joaquin River at Vernalis	459	749	0.313	3.9	102

Source: CALFED 2000a
mg/L = milligram per liter.
μS/cm = microsiemen per centimeter
Sampling period varies, depending on location and constituent, but generally is between 1990 and 1998.

Water quality data collected between 1996 and 1999 show that TDS levels at Banks Pumping Plant, in the Sacramento River at Hood, and in the western Delta at Old River at Station 9 never exceeded the secondary MCL for drinking water of 500 mg/L

(Table 5-27) (DWR 2001b). In the San Joaquin River near Vernalis, only 6 out of the 143 samples exceeded the secondary MCL for TDS. The secondary MCL for chloride is 250 mg/L, and the secondary MCL for electrical conductivity is 900 µS/cm. Because TDS is a measure of the total dissolved solids and does not measure the relative contribution of individual constituents such as chloride and bromide, it is possible to meet the secondary TDS MCL for (500 mg/L) but still exceed a standard for an individual salt constituent such as chloride (250 mg/L) (DWR 2001b). Because of this and because of their importance in formation of DBPs, chloride and bromide are addressed in detail in the following sections and Appendix G.

Table 5-27
Comparison of Total Dissolved Solids Concentrations at Selected Stations Within the Delta

TDS (mg/L)	***Sacramento River at Greenes/Hood***	***Old River at Station 9***	***Banks Pumping Plant***	***San Joaquin River Near Vernalis/Mossdale***
Mean	95	200	195	273
Median	92	173	182	261
Low	50	107	116	83
High	404	450	388	578
# of Detects/Samples	131/131	40/40	27/27	143/143

Source: DWR 2001b
TDS detection limit = 1.0 mg/L
Samples collected between 1996 and 1999

The seasonal changes in chloride concentrations at three locations are illustrated in Figure 5-2. The data represented in Figure 5-2 illustrate the median, 25th-percentile, and 75th-percentile chloride concentrations at the Banks Pumping Plant (Clifton Court), the Tracy Pumping Plant, and the Los Vaqueros Old River Intake for each month of the year. The lowest median concentrations of chloride typically occur in spring and early summer (March through July). The long-term monthly median concentrations of chloride for the period of record occurring under the Baseline Condition do not exceed the secondary MCL for chloride of 250 mg/L.

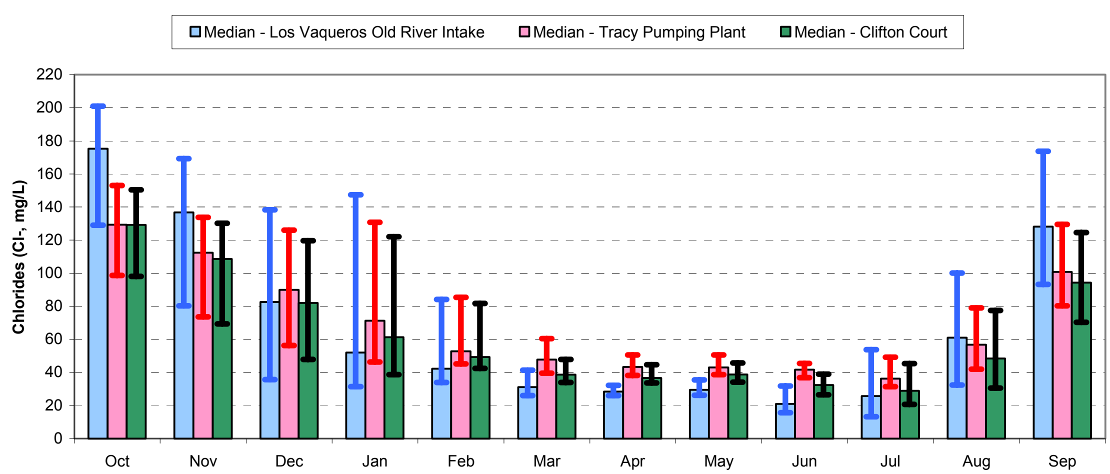
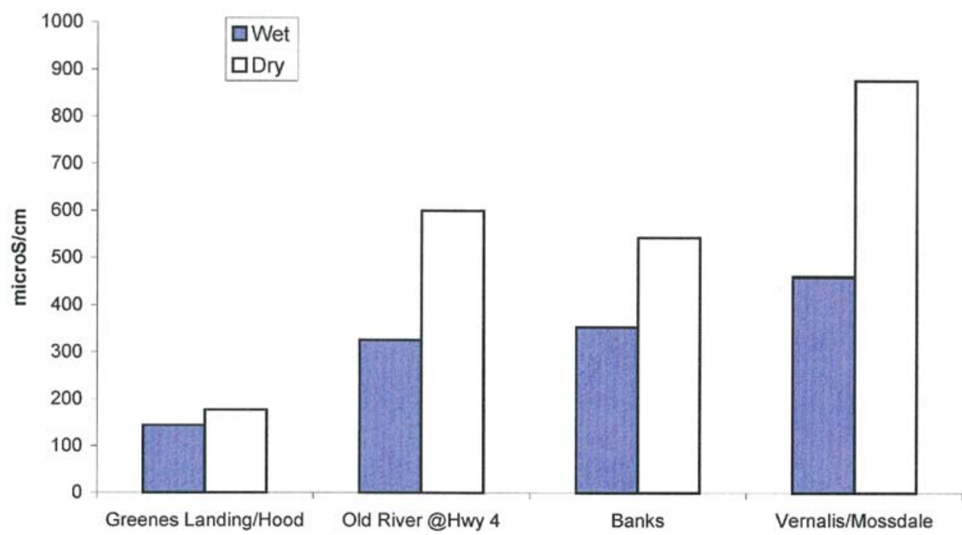


Figure 5-2
Long-term monthly median concentrations of chloride at Banks Pumping Plant (Clifton Court), Tracy Pumping Plant, and the Los Vaqueros Old River Intake under the Baseline Condition
Note: Bars represent the median and errors bars represent the 25th-percentile and 75th-percentile chloride concentrations.

Salinity patterns in the Delta also vary with water year type (DWR 2001b). As shown in Figure 5-3, salinity as measured by EC, a surrogate for TDS, is higher in dry years than in wet years (DWR 2001b). For the purpose of Figure 5-3, wet years are a combination of wet and above normal water year types and dry years are a combination of dry and critical water year types (DWR 2001b). In addition, a DWR project report (DWR 2000 *as cited in* DWR 2001b) found that EC levels generally were higher during low Delta outflows as compared to medium or high Delta outflows (DWR 2001b).



Source: DWR 2001b.

Figure 5-3
Average Electrical Conductivity (µS/cm) by Year Type at Selected Sites in the Sacramento-San Joaquin Delta (most samples collected monthly between 1990-1998)

<u>Bromide</u>
Bromides are formed by the reaction of bromine or a bromide with another substance and are widely distributed in nature (Columbia Encyclopedia 2003). For example, magnesium bromide, found in seawater, is a source of pure bromine (Columbia Encyclopedia 2003). Bromide is important from a drinking water perspective because during chlorination for disinfection of drinking water, bromide reacts with natural organic compounds in the water to form trihalomethanes. Four species of trihalomethanes (THMs) are regulated in drinking water including chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

The recently announced requirements under the Stage 1 D/DBPR require lower levels of bromate in drinking water (0.010 mg/L) than previously required (see Table 5-1). The LT1ESWTR requires additional disinfection, primarily pathogens such as *Cryptosporidium* and *Giardia*, and the requirement for increased disinfection has the potential to increase the quantity of disinfection by-product formed during disinfection. In order to meet stringent EPA drinking water standards, CALFED has proposed that the concentration of bromide levels at export pumps not exceed 0.05 mg/L (DWR 2001b). However, this recommendation is a non-enforceable target level.

The primary source of bromide in Delta waters is sea-water intrusion (CALFED 2000a). Other sources of bromide include drainage returns in the San Joaquin River and within the Delta, connate water beneath some Delta Islands, and possibly agricultural applications of methyl bromide (CALFED 2000a). The San Joaquin River and agricultural irrigation sources are primarily a "recirculation" of bromide that originated from sea-water intrusion (CALFED 2000a). As shown in Table 5-26, TDS, EC, bromide and chloride data indicate that seawater intrusion is highest in the western and southern portions of the Delta, where the direct effects of seawater intrusion and the effects of recirculated bromide from the San Joaquin River exist (DWR 2001b).

In addition to varying geographically within the Delta, bromide varies seasonally, in a pattern similar to that exhibited by salinity. The data represented in Figure 5-4 illustrate the median, 25th-percentile, and 75th-percentile bromide concentrations at the Banks Pumping Plant (Clifton Court), the Tracy Pumping Plant, and the Los Vaqueros Old River Intake for each month of the year. The lowest median concentrations of bromide typically occur in spring and early summer (March through July).

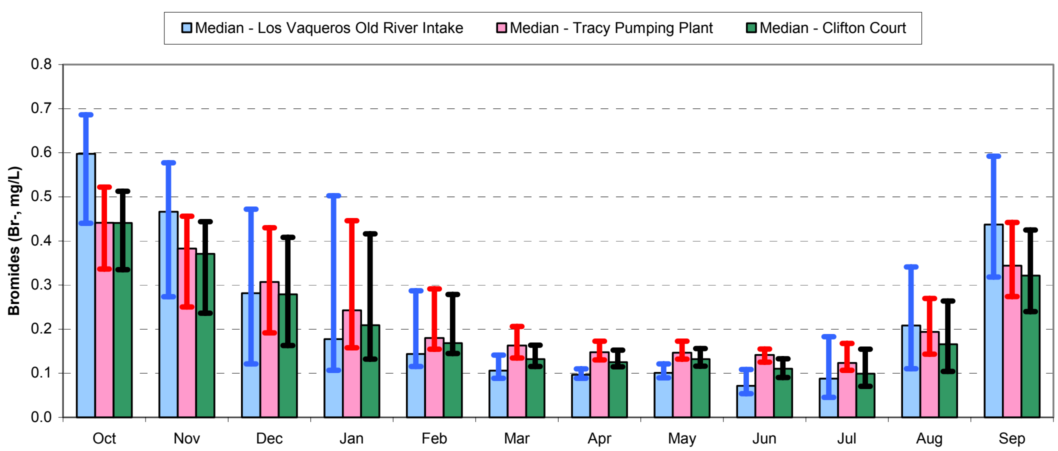
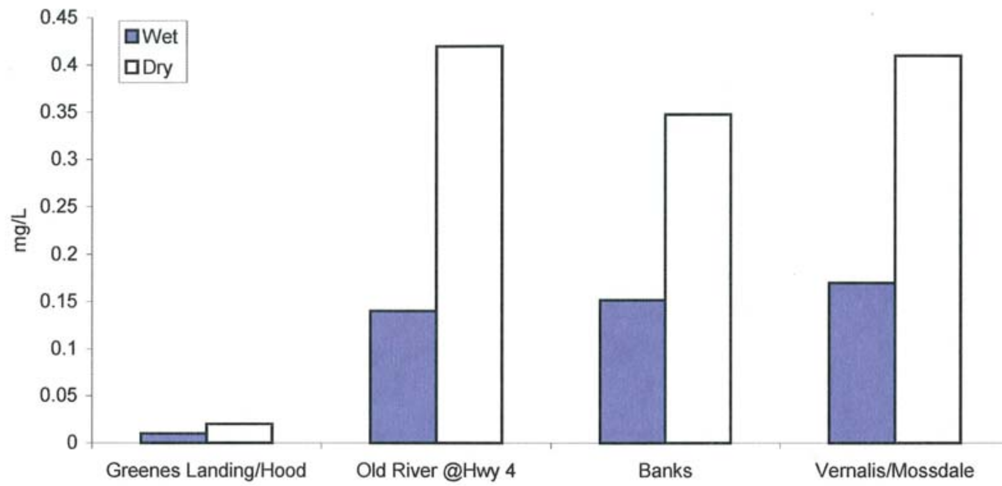


Figure 5-4
Long-term monthly median concentrations of bromide at Banks Pumping Plant (Clifton Court), Tracy Pumping Plant, and the Los Vaqueros Old River Intake under the Baseline Condition
Note: Bars represent the median and errors bars represent the 25th-percentile and 75th-percentile bromide concentrations.

In the Delta, water year has a strong influence on bromide concentration (DWR 2001b). Figure 5-5 illustrates that from 1990 to 1998, average bromide concentrations at four locations were higher in dry years than in wet years (DWR 2001b). For the purpose of Figure 5-5, wet years are a combination of wet and above normal water year types and dry years are a combination of dry and critical water year types (DWR 2001b).



Most samples collected monthly between 1990-1998.
Source: DWR 2001b.

Figure 5-5
Average Bromide Concentrations (mg/L) by Year Type at Selected Sites in the Sacramento/San Joaquin Delta

Organic Carbon

Naturally occurring organic compounds are present in surface waters as a result of degradation of aquatic vegetation and animal tissues. Scientists measure organic carbon using several methods. Dissolved organic carbon (DOC) is a measure of the dissolved organic carbon in the water, while TOC is a measure of all the organic carbon in the water, including organic carbon from particulate matter such as plant residues and DOC. Naturally occurring organic compounds, mainly humic and fulvic acids resulting from plant decay, are generally referred to as organic THM precursors. Organic carbon is important because of its role in the formation of DBPs, specifically THMs.

There is generally limited knowledge of the Baseline Condition of TOC at key Delta locations and tributaries, and limited understanding of TOC and DOC loads in the Delta system (DWR 2001b). With this caveat stated, there is some available data and information describing TOC and DOC concentrations in the Delta. Important sources of DOC and TOC to the Delta include the Sacramento River, the San Joaquin River, and in-Delta island drainage return flows (CALFED 2000a). Of the DOC loading contributed by tributary inflow, the Sacramento River is the major contributor to the Delta carbon load, contributing an estimated 71 percent of the total carbon load attributed to tributary inflow in the Delta (DWR 2001b). The Sacramento River is a major contributor because although its carbon concentrations are relatively low, approximately three-quarters of the inflow to the Delta comes from the Sacramento River (DWR 2001b). The San Joaquin River contributes approximately 20 percent of the total carbon load attributed to tributary inflow in the Delta (DWR 2001b). Drainage from Delta islands, particularly islands with highly organic peat soils, contributes significantly to the DOC load in the Delta (DWR 2001b). Studies conducted by DWR suggest that during the winter, 38 to 52 percent of the DBP-forming carbon in the Delta is contributed by Delta island drainage, while in the summer during irrigation, island drainage contributes to 40 to 45 percent of the DBP-forming carbon (DWR 2001b). In general, monitoring data suggests that most of the TOC in the Delta is in the form of DOC (CALFED 2000a).

As with salinity and bromide, organic carbon concentrations in the Delta vary both geographically and seasonally. Organic carbon patterns, however, in the Delta are somewhat different from salinity and bromide patterns in the Delta. Like salinity and bromide, organic carbon concentrations are higher in west and south Delta locations (Station 9, the San Joaquin River near Vernalis, and Banks Pumping Plant) than in the Sacramento River at Greenes Landing/Hood. Unlike salinity and bromide, organic carbon concentrations are typically lowest in the summer and higher during the rainy winter months. Appendix G further discusses organic carbon concentrations in the Delta.

5.1.5.3 Export Service Area

Water quality samples are routinely collected at 29 stations throughout the SWP. There also are 20 automated water quality monitoring stations that measure conventional parameters, including pH, EC, and turbidity.

5.1.5.3.1 California Aqueduct

The California Aqueduct is California's largest and longest water conveyance system, stretching 440 miles from the Sacramento-San Joaquin Delta in the north to Lake Perris in the south (DWR 2001b). The aqueduct and its branches supply water for two-thirds of California's population and irrigate approximately 1 million acres of farmland (DWR 2001b). Water quality data from the California Aqueduct were collected at four different sites: O'Neill Forebay Outlet (check 13), Kettleman City (check 21), near Highway 119 (check 29), and Tehachapi Afterbay (check 41). Data are generally collected monthly, although some parameters were not measured as frequently. The following figures present water quality data from January 1996 through December 1999 at each of the sampling sites (Figures 5-6 through 5-9).

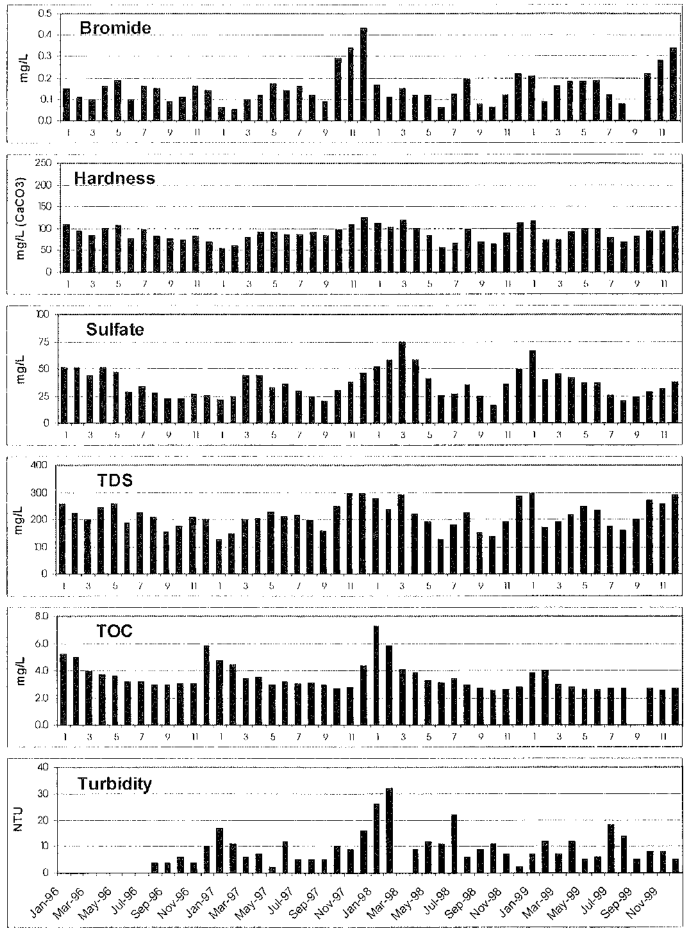


Figure 5-6
Water Quality on the California Aqueduct, Check 13

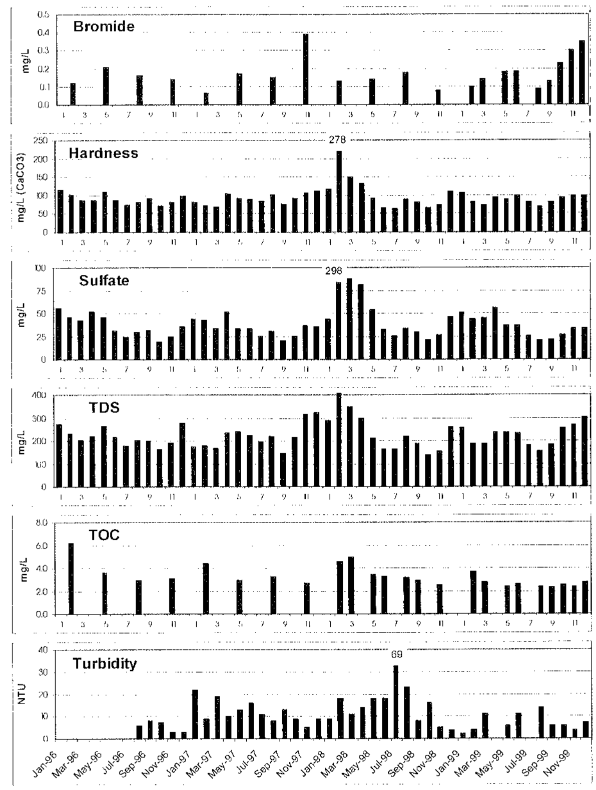


Figure 5-7
Water Quality on the California Aqueduct, Check 21

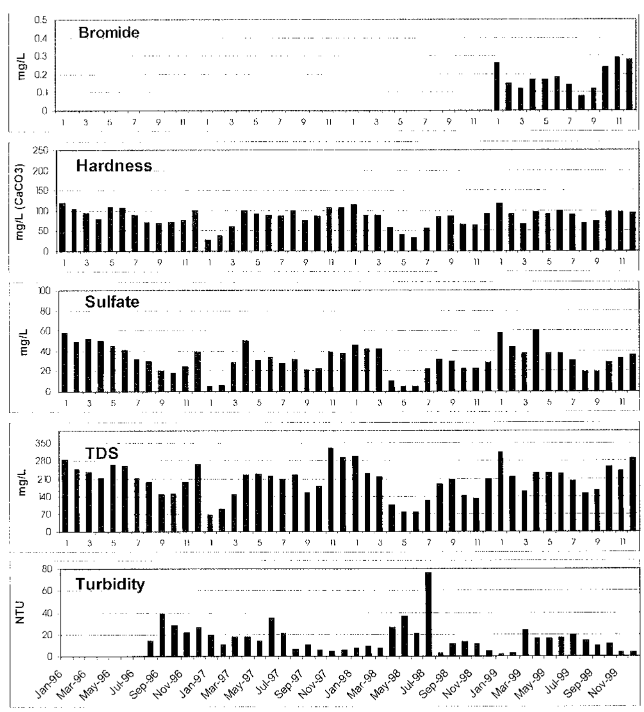


Figure 5-8
Water Quality on the California Aqueduct, Check 29

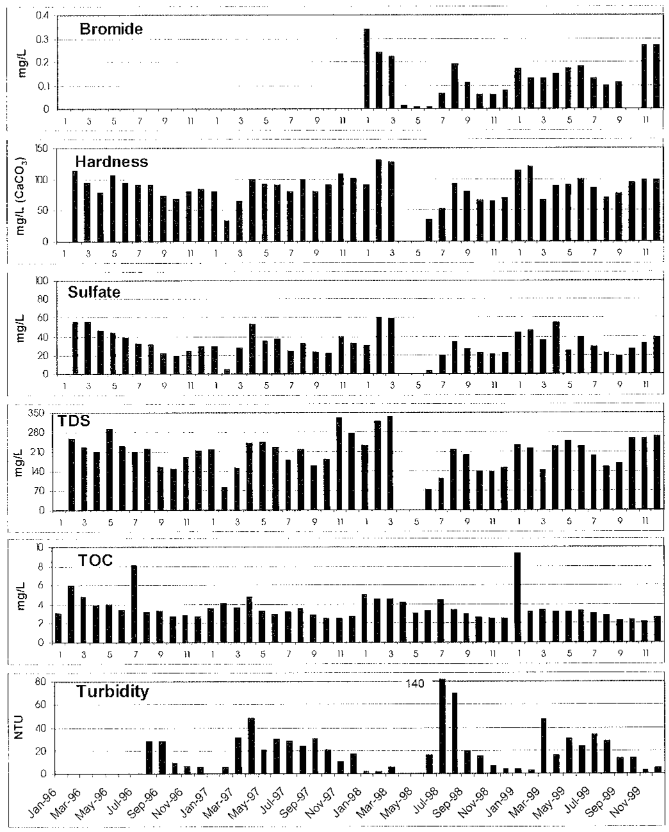


Figure 5-9
Water Quality on the California Aqueduct, Check 41

5.1.5.3.2 San Luis Reservoir

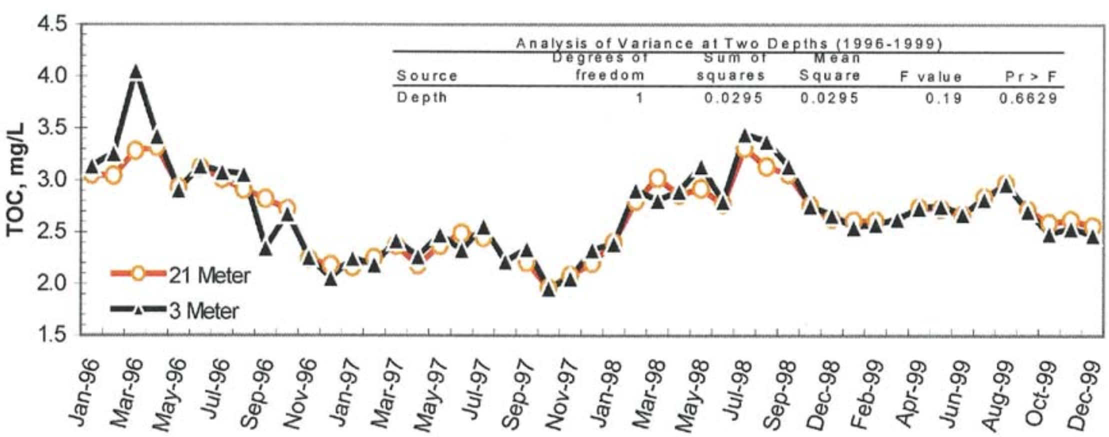
San Luis Reservoir is 12 miles west of the city of Los Banos on San Luis Creek, between the eastern foothills of the Diablo Range and the western foothills of the San Joaquin Valley in Merced County (DWR 2001b). This major off-stream reservoir of the joint-use San Luis Complex stores excess winter and spring flows from the Sacramento-San Joaquin Delta and supplies water to service areas for both the SWP and CVP (DWR 2001b). In general, the natural inflow from the San Luis Reservoir's watershed is insignificant relative to the reservoir's capacity (DWR 2001b). Most of the reservoir's water is pumped from the California Aqueduct and the Delta-Mendota Canal via the O'Neill Forebay through the Gianelli Pumping-Generating Plant during the winter and spring (DWR 2001b). Water enters and exits San Luis Reservoir from a common inlet/outlet tower (DWR 2001b). In addition, Reclamation pumps water out of San Luis Reservoir in a westerly direction to San Felipe Division Water contractors through the Pacheco Pumping Plant and the Santa Clara Tunnel (DWR 2001b). San Luis Reservoir water is delivered to the San Joaquin Valley, the Santa Clara Valley, and Southern California when water supply in the California Aqueduct and the Delta Mendota Canal is insufficient (DWR 2001b).

Table 5-28 presents data collected from 1996 to 1999 in San Luis Reservoir, including mean, median, low, and high concentrations for a variety of water quality parameters (DWR 2001b).

Table 5-28 San Luis Reservoir Water Quality Data, January 1996 to December 1999[1]							
Parameter	Mean[2]	Median[2]	Low[2]	High[2]	Percentile 10 to 90 Percent[2]	Reporting Limit	Detects/ Samples
pH (standard units)	7.7	7.7	7.2	8.6	7.3-8.2	0.1	22/22
Turbidity (NTU)	3	2	1	12	1-5	1	29/38
Total Organic Carbon (mg/L)[3]	2.7	2.7	2.0	4.1	2.2-3.1	0.1	92/92
Bromide (mg/L)	0.20	0.20	0.18	0.22	0.18-0.22	0.01	12/12
Chloride (mg/L)	65	64	48	78	56-76	1	48/48
Total Dissolved Solids (mg/L)	248	245	194	295	224-277	1	48/48
Conductivity (umhos/cm)	448	446	363	501	403-488	1	48/48
Nutrients							
Total Nitrogen[4] (mg/L)	1.0	1.1	0.7	1.4	0.8-1.0	0.1	27/27
Nitrate (as N) (mg/L)	0.6	0.6	0.1	0.9	0.3-0.8	0.1	45/47
Ammonia (dissolved) (mg/L)	0.03	0.02	0.01	0.10	0.01-0.06	0.01	22/47
Total Phosphorus (mg/L)	0.11	0.11	0.05	0.18	0.09-0.14	0.01	45/46
Orthophosphate (mg/L)	0.08	0.08	0.02	0.13	0.06-0.11	0.01	45/46

[1] Data were from DWR O&M Database, May 2000.
[2] Nondetects were not used for computation of these statistics.
[3] TOC data provided by Jeffrey Janik, DWR O&M, Feb 2001.
[4] Total nitrogen was the sum of Kjeldahl nitrogen and nitrate.
Source: DWR 2001b.

TOC samples were collected at the Pacheco Intake in San Luis Reservoir at two depths, 3 meters and 21 meters as shown in Figure 5-10 (DWR 2001b). An analysis of variance showed no significant difference between the carbon concentrations measured at the two depths during the same sampling day (DWR 2001b). TOC concentrations ranged from 2.0 to 4.1 mg/L, with an average concentration of 2.7 mg/L (DWR 2001b). These TOC levels are considered relatively high for source water, but were lower than the TOC measurements at the Banks Pumping Plant (DWR 2001b). There was no apparent seasonal trend in carbon levels within each year, except in 1996, when carbon levels appeared to be higher in January through March, and then declined (DWR 2001b).

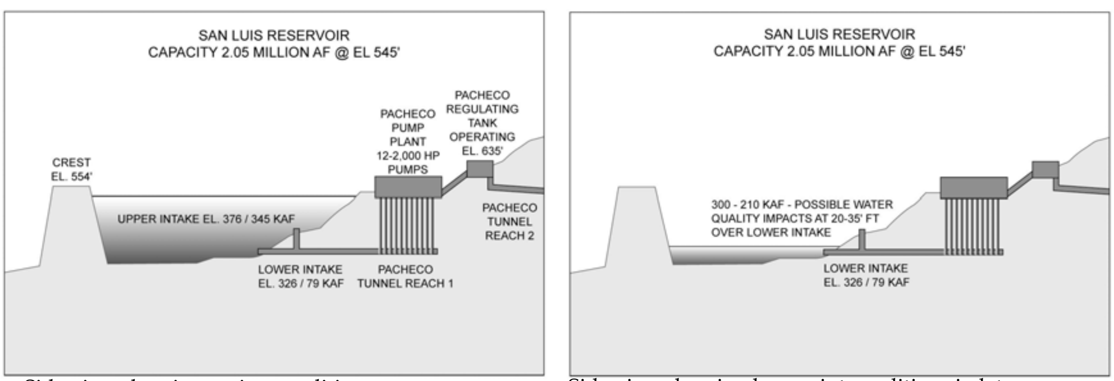


Source: DWR 2001b

Figure 5-10
Monthly Total Organic Carbon Measured at Two Depths

Bromide samples were collected monthly in 1999 and ranged from 0.18 to 0.22 mg/L, with a mean of 0.20 mg/L (DWR 2001b). Measured bromide values exceeded the recommended CALFED target of 0.05 mg/L (DWR 2001b). High bromide concentrations result from source water from both the California Aqueduct and the Delta Mendota Canal, which are affected by tidal inflows and seawater intrusion (DWR 2001b).

In San Luis Reservoir, the low-point problem and associated algal growth is the primary concern. In San Luis Reservoir, the low point refers to a range of minimum reservoir levels that occur in late summer and fall. The low-point problem is produced by a combination of warm-season algae growth and decreasing summer water levels. San Luis reservoir typically is at its high point in late winter and early spring, following the rainy season. During the spring and early summer, water is released from San Luis Reservoir into O'Neill Forebay. Additionally, some water is pumped through the Pacheco Pumping Plant for distribution to San Felipe Division contractors (including the Santa Clara Valley WD) via an upper intake located at approximately elevation 376 feet (Figure 5-11). As the summer progresses, algae begins to grow near the reservoir surface. At the same time, the reservoir water surface elevation decreases as water is withdrawn for the summer peak use season. The upper Pacheco intake at elevation 376 feet is closed when the reservoir water surface elevation reaches approximately 406 feet. For the remainder of the dry season, water is pumped through the Pacheco Pumping Plant via the lower intake, located at approximately 334 feet (Santa Clara Valley WD 2002).



Side view showing spring conditions | Side view showing low-point conditions in late summer

Source: Santa Clara Valley WD 2002.

Figure 5-11
San Luis Reservoir Low-Point Conditions

The low-point problem begins when the reservoir water surface elevation approaches 369 feet, corresponding to a storage capacity of 300,000 acre-feet. At this capacity, the water surface elevation in the reservoir is approximately 35 feet above the lower intake to the Pacheco Pumping Plant. Because the near-surface algae layer can be more than 30 feet thick in late summer, algae may be drawn into the lower intake. High algae content reduces the effectiveness of water treatment and can affect the quality and taste of treated water. As the reservoir is progressively drawn down below 300,000 acre-feet, increasing amounts of algae may enter the intake, and water quality problems can worsen. When the water surface elevation reaches approximately 354 feet (209,000 acre-feet), algae concentrations may be so high that the water delivered to the Pacheco Pumping Plant is untreatable (Santa Clara Valley Water District 2002).

Historical data suggest that algal blooms caused taste and odor problems for the Santa Clara Valley Water District (WD) during the drought years from 1992 to 1993 (DWR 2001b). From 1996 to 1999, the Santa Clara Valley WD did not report any serious algal blooms and taste and odor were not serious water quality concerns during this period (DWR 2001b). There were no drought years during this period, and precipitation records show that rainfall was heavy in 1995 and 1996, reaching a record high of 24.1 inches in the reservoir watershed during 1998 (DWR 2001b). Strong winds mix the surface water with water at greater depths, making it less likely that a thermocline will become established in the reservoir (DWR 2001b). Wind disturbances and the lack of thermocline establishment apparently limited growth of blue-green algae during this period (DWR 2001b).

Typically, taste and odor concerns associated with algal growth in the reservoir are more serious water quality concerns during drought years (DWR 2001b). In the fall, especially during drought years, a greater demand by SWP contractors creates lower water levels in the reservoir (DWR 2001b). Because of the improved light penetration and greater likelihood of establishment of a thermocline in the reservoir, algal blooms, consisting primarily of the blue-green algae *Aphanizomenon flosaquae*, are more likely to occur (DWR 2001b). During fall months, winds blow accumulated blue-green algae toward the intake, and taste and odor concerns may result (DWR 2001b).

5.1.5.3.3 Anderson Reservoir

Anderson Dam and Reservoir was built in 1950 and is the largest man-made lake in Santa Clara County (Santa Clara Valley WD 2002). Anderson Reservoir is in the Coyote Creek watershed of central Santa Clara County. Coyote Creek is a south-to-north trending drainage that discharges into the southern end of South San Francisco Bay. Anderson Reservoir is managed by the Santa Clara Valley WD for water supply and flood control purposes. The reservoir is filled in the winter and spring using runoff collected from within the watershed and from San Luis Reservoir. When full, the reservoir holds 111,198 acre-feet. At present, the Santa Clara Valley WD maintains a minimum pool amount of 20,000 acre-feet for summer recreation and emergency storage[1].

Since late 1996, the Santa Clara Valley WD has found low levels of a gasoline additive known as MTBE present in Anderson Reservoir. At very low levels, this substance can foul the taste and odor of drinking water. To help control the amount of MTBE entering the reservoir, county parks have reduced the number of boats, allowing access only to vessels fueled with MTBE-free fuel. They have also relocated personal watercraft to Calero Lake, instituted controls on refueling, and are providing boating safety education through park rangers (Santa Clara Valley WD 2002a).

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1 Coyote Creek, Stevens Creek, and Guadalupe River Watersheds – Fisheries and Aquatic Habitat Collaborative Effort: Summary Report. February 26, 2003. (Akin, et al.)

The reservoir is filled with water from San Luis Reservoir, so the water quality within Anderson Reservoir is would be similar to that for San Luis Reservoir. For information on the water quality within San Luis Reservoir, please refer to Section 5.1.5.3.2.

5.1.5.3.4 Castaic Lake

Castaic Lake is two miles north of the community of Castaic, 45 miles northwest of downtown Los Angeles, in the southeast portion of the Angeles National Forest. The lake is the terminus of the West Branch of the California Aqueduct and is used to supply water to southern California users. The watershed and the lake combined encompass a total of 154 square miles, with the surface area of Castaic Lake covering approximately 2,240 acres (approximately 3.5 miles). Castaic Lake is fed by natural and SWP sources. Along with the California Aqueduct (via Pyramid Lake and the Elderberry Forebay), the two main sources of natural inflow are Castaic Creek on the northwest arm and Elizabeth Lake Canyon Creek on the northeast arm of the lake. Historic average annual natural inflows from the watershed have been estimated to be about 23,000 acre-feet (Brown and Caldwell 1990 *cited in* DWR 2001b). Average SWP inflows from 1996 to 1998 were approximately 307,500 acre-feet (DWR 2001b). SWP water is withdrawn from Castaic Lake at West Branch mile 31.55 via the Castaic Tunnel and distributed to three agencies, the Metropolitan Water District of Southern California (Metropolitan WD), the Castaic Lake Water Agency, and the Ventura County Flood Control and Water Conservation District.

Primary land uses in the Castaic Lake watershed include recreation and related activities, livestock grazing, limited residential development and some historic mining (DWR 2001b). Each of these represents a potential source of contamination to the lake by the direct addition of contaminants or by increasing potential runoff into the lake. Wastewater treatment facilities such as septic systems, algal blooms, crude oil pipelines, spills from traffic accidents, geologic hazards, fires, and future construction within the watershed represent additional potential sources of contamination to the lake.

Castaic Lake water quality is affected by outflow from Pyramid Lake and the Elderberry Forebay as well as the small natural streams feeding the lake, particularly Castaic Creek. Table 5-29 presents data collected by DWR's Division of Operation and Maintenance Castaic Lake outlet. All parameters in Table 5-29 were below drinking water MCLs for the monitoring period (DWR 2001b). The data were taken from February 1996 through November 1999 with the exception of bromide and pH data. Bromide data were collected from November 1998 to August 1999. Alkalinity data expressed as pH were collected from February 1998 to November 1999.

Table 5-29 **Water Quality Parameters Sampled at Castaic Lake**			
Parameter	***Minimum***	***Maximum***	***Average***
pH (standard units)	7.4	9.1	8.3
Turbidity (NTU)	<1	3	2
Dissolved Oxygen (mg/L)	N/A	N/A	N/A
Total Organic Carbon (mg/L)	2.5	7.7	4.0
Nitrogen (mg/L)	0.2	0.8	0.4
Phosphorus (mg/L)	0.01	0.09	0.03
Electrical Conductivity (µS/cm)	479	627	535
Chloride (mg/L)	41	54	46
Bromide (mg/L)	0.12	0.15	0.13

Source: DWR 2001b
N/A – Not Available

5.1.5.3.5 Lake Perris

Lake Perris is the terminal reservoir of the East Branch of the California Aqueduct and is approximately 13 miles southeast of the City of Riverside and approximately 65 miles from downtown Los Angeles within Riverside County. The lake is a multiuse facility providing water storage, recreation, and fish and wildlife habitat. The Lake Perris watershed encompasses approximately 16 square miles and is fed almost exclusively by the California Aqueduct with no significant natural inflow. SWP water flows into Lake Perris from the Devil Canyon Afterbay, through the Santa Ana Pipeline. The Metropolitan WD is the only agency contracting water deliveries from Lake Perris. Ultimately, approximately 17 million people receive part of their drinking water from Lake Perris each year (DWR 2001b).

Lake Perris becomes thermally stratified in the summer months presenting some significant water quality concerns that limit the use of lake water. High nutrient levels in the epilimnion (upper level) stimulate nuisance algae growth that degrades the odor and taste of the water and causes treatment difficulties by clogging filters. In addition, microbial respiration fueled by periodic algae die-offs cause anoxic conditions in the hypolimnion (lower layer). Anoxic water decreases aesthetic values and is difficult and expensive to treat. In addition to nutrient enrichment, recreation, wastewater treatment and facilities, urban runoff, animal populations, and leaking storage tanks have contributed contaminants to the lake in the past (DWR 2001b).

Table 5-30 presents data collected by DWR's Division of Operation and Maintenance at the Lake Perris outlet. All parameters were below drinking water MCLs for the monitoring period (DWR 2001b). The data were taken from February 1996 through November 1999 with the exception of bromide data. Bromide data were collected from February 1999 to August 1999.

Table 5-30 Water Quality Parameters Sampled at Lake Perris			
Parameter	**Minimum**	**Maximum**	**Average**
pH (standard units)	7.4	8.9	8.2
Turbidity (NTU)	<1	8	1
Dissolved Oxygen (mg/L)	N/A	N/A	N/A
Total Organic Carbon (mg/L)	N/A	N/A	N/A
Nitrogen (mg/L)	0.3	1.2	.5
Phosphorus (mg/L)	<0.01	0.15	0.04
Electrical Conductivity (µS/cm)	483	712	591
Chloride (mg/L)	65	121	89
Bromide (mg/L)	0.20	0.22	0.21

Source: DWR 2001b
N/A – Not Available

5.1.5.3.6 Diamond Valley Lake

Diamond Valley Lake is the largest drinking water reservoir in southern California. It is in southwestern Riverside County, approximately four miles southwest of the City of Hemet and approximately 90 miles southeast of Los Angeles. The reservoir has a capacity of approximately 800,000 acre-feet and a surface area of approximately 4,400 acres. The Diamond Valley Lake watershed encompasses approximately 17.4 square miles and is primarily fed by the SWP and the Colorado River (Metropolitan WD 1991). Warm Spring and Goodhart Canyon creeks also contribute a small amount of water to the lake. The Metropolitan WD owns and operates the reservoir as a multi-use facility providing water storage, drinking water, hydroelectric power generation and recreational uses to southern California users (Metropolitan WD 1991).

Construction of the three dams holding Diamond Valley Lake water was completed in 1999 (Water Technology 2003). The reservoir was dedicated March in 2000 and began generating electricity in May 2001 (Metropolitan WD 2001a; Metropolitan WD 2001b). Due to the lack of publicly available data and the short operating time of the reservoir, water quality data were not available for Diamond Valley Lake.

5.1.5.3.7 Lake Mathews

Lake Mathews Reservoir was completed in 1939 by the Metropolitan WD of Southern California as the western terminus for the Colorado River Aqueduct. Lake Mathews is within Riverside County approximately five miles southeast of Corona and three miles south of Riverside. Before the construction of Diamond Valley Reservoir, Lake Mathews was the largest reservoir operated by Metropolitan WD, and it remains the oldest. Lake Mathews holds up to 182,000 acre-feet.

The lands immediately surrounding the lake have been held by the Metropolitan WD, and human intrusions have been few. As Riverside continued to grow during the latter part of the century, surrounding areas began to be developed primarily as custom built homes on small ranchettes. Additionally, since the 1930s, many of the surrounding lands were and continue to be used for citrus agriculture. In July 1997, the SWRCB approved a resolution project for the Drainage Water Quality Management Plan (DWQMP) for the Lake Mathews Watershed Project. The project is designed to protect Lake Mathews from nonpoint source and storm water pollution originating in the upstream watershed. The facilities include natural wetlands, ponds and a dam to purify the contaminated runoff (SWRCB 1998). In October 2002, Metropolitan WD was awarded the Outstanding Civil Engineering Project of the Year for their DWQMP project. In addition, as part of a mitigation plan for its water projects, and recognizing the value to wildlife of such a large, open source of water, the Metropolitan WD lands (approximately 4,000 acres) surrounding the lake were formally designated as a State Ecological Reserve in 1982.

Public access within the Lake Mathews Reserve is limited to non-Metropolitan WD lands only, and the lake is not open for public recreation. The Reserve is open daily from dawn to dusk, but since motorized vehicles are not allowed on Reserve lands, access to these non-Metropolitan WD lands is by foot or horse travel only (Center for Natural Lands Management 2003).

In July 2002, Metropolitan WD officials announced that the musty taste and odor in their tap water was not a health hazard, but an aesthetic problem. The earthy taste and odor came from an especially large persistent algal bloom within the California Aqueduct and Lake Mathews. The cause was identified as 2-methylisoborneal (MIB) and geosmin, whose growth tends to increase in the summer months with the warmer temperatures. DWR applied copper sulfate to the east end of the California Aqueduct to control the algal bloom. Investigations took place at Lake Mathews to determine if a similar treatment was needed at this location (Metropolitan WD 2002).

Lake Mathews receives its water from the Colorado River Aqueduct, but water supplies from this source are much higher in salinity than those from the SWP, so the water is blended at the Robert A. Skinner Filtration Plant at Lake Skinner before it is delivered. Table 5-31 presents data collected for the 2001 Consumer Confidence Report at the Robert A. Skinner Filtration Plant for a variety of water quality parameters. As illustrated in Table 5-31, pH ranged from 8.03 to 8.10, with an average of 8.06 (Rincon 2003). TDS concentrations ranged from 480 mg/L to 521 mg/L and averaged 500 mg/L, which is lower than the State MCL of 1000 mg/L (Rincon 2003). Conductivity was not high in the reservoir, with values ranging from 813 µmhos/cm to 876 µmhos/cm, falling well within the State MCL range of 900 to 1600 µmhos/cm (Rincon 2003).

Table 5-31
Water Quality Parameters Sampled at the Robert A. Skinner Filtration Plant

Water Quality Parameter	*Minimum*	*Maximum*	*Average*
pH (standard units)	8.03	8.10	8.06
Turbidity (mg/L)	0.05	0.07	0.06
Dissolved Oxygen (mg/L)	N/A	N/A	N/A
Total Dissolved Solids (mg/L)	480	521	500
Nitrogen (mg/L)	N/A	N/A	N/A
Phosphorus (mg/L)	N/A	N/A	N/A
Electrical Conductivity (µS/cm)	813	876	836

Source: Rincon 2003.
N/A – not available

5.2 Environmental Consequences/Environmental Impacts

5.2.1 Assessment Methods

The assessment methods and effects evaluation for water quality were organized by EWA acquisition type because each acquisition type required a different assessment method and effects analysis. Additionally, for some acquisition types, the assessment methods and effects evaluations were similar for several geographic regions and therefore several geographic regions were grouped together under various acquisition types. Because the grouping of geographic regions varied by acquisition type, structuring the entire analysis by geographic area within acquisition type allowed for the most condensed and least redundant presentation of the assessment methods and effects analysis.

The assessment methods and effects analysis are presented in the following order:

- Stored Reservoir Water (Including Stored Water Acquired From Crop Idling and Groundwater Substitution);
- Crop Idling;
- Stored Groundwater Purchase;
- Groundwater Substitution; and
- Source Shifting.

5.2.1.1 Stored Reservoir Water (Including Stored Water Acquired from Crop Idling and Groundwater Substitution)

This analysis uses changes in reservoir storage and water surface elevation to determine potential water quality effects under the Flexible Purchase Alternative. When a reservoir has a higher water surface elevation, there would be an improvement in water quality (greater dilution of constituents of concern). Conversely, when water surface elevations were shown to be lower than the baseline condition, it was expected that there would be a potential for impaired water quality (less stratification, warmer water, concentration of pollutants, and greater sediment exposure around the shoreline).

Storage volumes are an important analytical component for water quality because they provide an indication of dilution factors for constituents of concern. The volume of the cold water pool also provides an indication of water quality available to coldwater fisheries, and may indirectly provide an indication that there is a sufficient quantity of dissolved oxygen available to support aquatic life and natural benthic processes. In addition, the cold water pool is often relied upon to ensure the health and protection of downstream riverine fish, particularly with respect to anadromous salmonid spawning and rearing activities.

Water temperature-related effects are also important to consider because such changes may result in direct effects to water quality. With regard to aquatic pollution and water quality in the project reservoirs, a greater volume of water present in a particular waterbody equates to a greater amount of dilution regarding any constituent of concern that may be present in the water. Hence, greater dilution results in exposure to a lower concentration of any substance that is present in the water and also will result in less stress to aquatic organisms. Metals and other constituents of concern that normally settle out of suspension and concentrate in the sediments most likely would remain within the sediments and would not be disturbed by fluctuations in surface water elevation. Temperature also plays a role in how quickly certain physical, chemical and biological reactions occur. For instance, the respiration and metabolic rates of most aquatic organisms tend to increase in warmer water. Increased water temperature also can accelerate oxygen demand and bacterial respiration associated with decomposition of organic matter. Water temperature effects to water quality were only quantitatively evaluated in the water quality analysis for rivers, because current modeling simulations cannot predict water temperature variations within the project reservoirs. However, it was expected that if surface water elevations and storage volumes do not fluctuate beyond the range of normal operating conditions, reservoir water temperatures also would remain within normal operational ranges.

5.2.1.1.1 Reservoirs within the Upstream from the Delta Region

EWA acquisitions could result in alterations to storage and water surface elevations for CVP/SWP and non-Project reservoirs within the area of analysis. The following reservoirs potentially could be affected by EWA acquisitions:

- Shasta
- Little Grass Valley
- Sly Creek
- French Meadows
- Hell Hole
- Folsom
- Oroville
- New Bullards Bar
- McClure

In response to day-to-day operations and changes in runoff patterns, fluctuations in storage and water release patterns in these reservoirs potentially could affect reservoir water quality due to alterations in the timing and magnitude of reservoir drawdown activities. Methods used to determine potential effects to water quality within CVP/SWP project reservoirs and non-Project reservoirs are discussed below.

<u>Central Valley Project/State Water Project Reservoirs</u>
For reservoirs within the CVP/SWP system, modeling was conducted to characterize CVP/SWP reservoirs and their associated rivers. Modeling of reservoirs within the CVP/SWP system in the Upstream from the Delta Region is described in Attachment 1. Attachment 1 describes in detail the EWA water purchase assumptions and assumptions regarding total available EWA assets for water purchased in the Upstream from the Delta Region.

For each of the CVP/SWP reservoirs, the analysis looked at the end of month reservoir water surface elevation and end of month reservoir storage for each month of the year to determine potential water quality effects that may result from implementation of the EWA Program. Modeling output was used to evaluate changes in water surface elevation and reservoir storage for each month of the year. These parameters were selected as effect indicators because of the interrelationships that exist between physiochemical and biological processes, and water quality. Modeled temperate changes within 0.3ºF (for rivers only), river flows and reservoir storage changes within one percent, and reservoir elevation changes within one foot between modeled simulations were considered to represent no measurable change (were considered "essentially equivalent").

CVP/SWP reservoirs were additionally analyzed with respect to water year type. The data developed and used for the critical, dry, and below normal years types was based on the model output described in Attachment 1. The analysis for each water year type analyzed the same metric used in the analysis of the entire 72-year period of record. Critical years, dry years, and below normal years were analyzed as three separate groups with respect to end-of-month water surface elevation and end-of-month storage. For each water year type, the long-term average end-of-month water surface elevation and end-of-month storage was examined for each month of the year.

<u>Non-Project Reservoirs</u>
There are several non-Project reservoirs that could serve as potential water sources for EWA acquisitions. Because these non-Project reservoirs are not managed under the operations of either the CVP or SWP, they are not included in the CALSIM modeling simulations. Non-Project reservoirs evaluated include:

- Hell Hole
- Little Grass Valley
- French Meadows
- Sly Creek
- New Bullards Bar
- Lake McClure

The following method of evaluating potential effects from EWA actions was used to analyze possible project-related effects on non-Project reservoirs. The evaluation assumptions were established with regard to the status and operation of these reservoirs. These assumptions were applied to the analysis for each of the non-Project reservoirs where the EWA Program could purchase water.

- Non-Project reservoir operations would continue to function under the same set of demands and assumptions that have previously been employed by each system in earlier years, including reservoir drawdown to targeted storage levels.

- Analysis relating to the timing, magnitude and duration of water transport activities and their potential effects on riverine flow processes were developed using a monthly time-step, culminating at the end of the water year in late-September. Where applicable, the period of time that was used to evaluate resource-specific effects (e.g., water quality, fisheries) concurred with the timeframe associated with potential asset transfers, as identified in the available modeling output for the EWA Program.

- EWA asset availability from non-Project reservoirs and any associated potential effects were evaluated by reviewing hydrologic data and reservoir specific area-capacity curves to predict changes in surface water elevation and reservoir refill frequencies. This information provides an indication of the target storage capacities, minimum pool volume and range of surface water elevations under normal operating conditions, and the probability of annual refill for each reservoir. Estimations for flow changes were translated into relative changes in surface water elevations and used to evaluate resource specific effects.

Additional information regarding assumptions for each non-project reservoir is provided in Attachment 1. In order to identify potential effects to water quality within non-Project reservoirs, a comparison of reservoir storage elevations was conducted using median reservoir storage and median water surface elevation values over the historical period of record, using current operating parameters as a baseline. These values were then compared against potential EWA actions to determine positive or negative fluctuations in reservoir levels. It was assumed that EWA acquisition amounts would be released evenly over a given period. The resulting estimates were used to determine the likelihood that decreases in reservoir water surface elevations of sufficient magnitude and frequency would occur over the long-term and result in negative effects to water quality within the non-Project reservoirs.

Because this comparison method supplies the most average result, 50 percent of the time actual reservoir levels will be higher and 50 percent of the time the actual levels will be lower than those used in the baseline. If reservoir levels differ greatly from the Baseline Condition during a transfer year, effects to water quality also may differ from those predicted by the analysis. If actual reservoir levels are higher than the historical average, the actual effects to water quality may be less than the predicted effects. If actual reservoir levels are lower than the historical average, the actual effects may be greater than the predicted effects.

Limitations have been placed on the maximum volume of water potentially available to EWA from each non-Project reservoir, based upon reservoir size, operational constraints and the existing refill patterns within each basin. Additionally, EWA asset acquisitions must not result in a reduction of reservoir surface water elevation beyond the minimum reservoir drawdown levels as stated in corresponding Federal Energy Regulatory Commission (FERC) licenses, where applicable. This documentation and any related material also was reviewed to ensure compliance with all appropriate regulatory requirements. See Attachment 1 for additional reservoir-specific information.

Non-Project reservoirs were additionally analyzed with respect to water year type. The data developed and used for the critical, dry, and below normal years types was based on the Sacramento River 40-30-30 index used by CALSIM II. For those reservoirs modeled for the period of 1970 to 2001, there were seven critical years, five dry years, and two below normal years. Because there were so few below normal years during the period of record, the dry and below normal years were combined within the data output for a total of seven years. For those reservoirs modeled for the period of 1974 to 2001, there were seven critical years, five dry years, and one below normal year. The dry and below normal years also were combined within the data output for this period of record as well for a total of six years.

5.2.1.1.2 Rivers Within the Upstream from the Delta Region

This section provides a discussion of the application of available hydrologic modeling output used in the determination of potential effects to water quality in the riverine environments that are within the EWA Program area of analysis. As described above, Attachment 1 includes additional detailed information regarding the assumptions utilized in the hydrologic modeling, assumptions regarding EWA water purchases and assumptions regarding EWA actions for the purpose of analyzing the Upstream from the Delta Region. Potential effects to water quality associated with the implementation of EWA actions were determined through an evaluation of the degree of change between the Baseline Condition and the EWA Program alternatives, as compared to thresholds of significance relating to designated beneficial uses, exceedance of existing water quality standards, and degradation of water quality.

Two different methods were employed to assess the water quality parameters specific to rivers that could be affected by EWA actions. The same methodology was used to assess potential effects to water quality in the Sacramento, lower American, lower Feather, Merced, and San Joaquin rivers. Flow and water temperature, where available, were used as the criteria to quantitatively evaluate potential effects to water quality within riverine environments. The analysis of potential effects to water quality focused on the frequency and magnitude of changes in mean monthly flow and mean monthly water temperature over the long-term, as compared to the Baseline Condition.

The above-named rivers were additionally analyzed with respect to water year type. The data developed and used for the critical, dry, and below normal year types was based on the model output described above. The analysis for each water year type evaluated the same metrics used in the previously described analysis of the entire 72-year period of record. Critical years, dry years, and below normal years were analyzed as three separate groups with respect to monthly flow and monthly water temperature. For each water year type, the long-term average monthly flow and monthly water temperature was examined for each month of the year.

Assessments of the Middle Fork American River and the lower Yuba River utilized an alternate methodology described below.

<u>Lower Yuba River</u>
To assess potential flow-related and water temperature-related effects on water quality in the Yuba River, comparisons were made "with" and "without" EWA Program-related transfer flows. Limited modeling output was available to assess the potential effects of the EWA Program. Therefore, to assess potential effects to water quality under the EWA Program, data was summarized describing flow and water temperature during past EWA transfers. Flow data from USGS gages at Marysville and Smartville were summarized, as well as water temperature data from USGS

gages at Marysville and Daguerre Point Dam. As with other rivers in the Sacramento and San Joaquin river basins, flow and water temperature criteria were used to evaluate potential effects to water quality in the Yuba River. The analysis of potential effects to water quality under the EWA Program in the Yuba River was based on data from previous EWA water transfers and focused on the frequency and magnitude of changes in mean daily flow and water temperature over the long-term, as compared to the Baseline Condition.

Middle Fork American River

Potential effects to water quality in the Middle Fork American River associated with EWA acquisition of stored reservoir water in French Meadows and Hell Hole reservoirs was assessed using the following methodology. Potential effects to water quality in the Middle Fork American River were analyzed using historical median flows because there was no modeling output available for this river. For the Middle Fork American River, the evaluation of potential effects to water quality was performed by comparing potential changes in flow resulting from implementation of the EWA Program to historical median flows. The analysis of potential flow-related effects to water quality focused on the frequency and magnitude of changes in mean monthly flow over the long-term, as compared to the historical period of record.

5.2.1.1.3 Sacramento-San Joaquin Delta Region

This section describes the evaluation methods for assessing the potential effects of the proposed EWA Program on water quality within the Sacramento-San Joaquin Delta Region. EWA operations have the potential to affect Delta water quality in years when CVP/SWP pumping is reduced below levels that would have been pumped in the absence of EWA actions, and when the loss of CVP/SWP project water is repaid in whole or in part by pumping water acquired from water users in the Upstream from the Delta Region through the Delta during the summer months. Pumping reductions would occur in the winter and spring months during EWA actions. When EWA acquires water upstream from the Delta to repay or assist in repaying the CVP/SWP for water lost during pumping reductions that water would be provided in the Delta when there is pumping capacity available at the SWP and/or CVP pumps and would, in most years, be replaced before the end of September. The result would be increased CVP and/or SWP pumping during the July through September period. As described in Chapter 2, no EWA actions (pumping reductions) would be taken at pumping locations other than at the Banks and Tracy Pumping Plants.

Salinity, bromide and organic carbon are specific water quality constituents of concern in the Delta with respect to implementation of EWA, as described in Section 5.1.5.2.1. The EWA Program has the potential to affect water quality in the Delta and has the potential to affect the quality of water supplied to downstream CVP and SWP water users. The methods for the analysis for each potential effect are described separately in this section. The analysis of potential effects to water quality in the Delta includes an analysis of potential effects to water quality for all in-Delta water users, including Contra Costa WD. The analysis of potential effects to in-Delta water quality consists of a detailed qualitative treatment of the use of carriage water (see Chapter 2) to maintain Delta water quality standards. In addition to the description in the Chapter 2, the analysis presented in Section 5.2.5.1.4 defines carriage water and evaluates the use of carriage water to protect Delta water quality. The evaluation includes a qualitative comparison of the chloride, bromide and organic carbon concentrations occurring under the EWA Program and under the Baseline Condition.

In order to evaluate the potential affects of EWA Program implementation to the quality of water supplied to CVP and SWP water users south of the Delta, quantitative modeling analysis of chloride and bromide loading was conducted and a qualitative analysis of organic carbon was conducted. Salinity and bromide were analyzed together using DWR/Reclamation models for several reasons. Salinity and bromide behave in similar fashions with respect to annual and seasonal variation, variation in water year type and variation in Delta outflow, as detailed in Section 5.1.5.2.1. Additionally, except for salinity predictions (including predictions of chloride and bromide), which are made possible by available mathematical modeling tools, there is currently little consensus regarding the ability to predict levels of other water quality constituents (such as organic carbon) that are present in the Delta Estuary (CALFED 2000a). Because bromide has the potential to chemically react with organic matter present in the water, thereby leading to the formation of THMs, the potential for THM formation was assessed using quantitative modeling techniques. Bromate formation was also assessed using the modeling techniques described below. The methods for evaluating chloride and bromide are discussed together, and the methods of analysis for organic carbon is described separately below.

In years when EWA actions occur in the Delta, the quality of water delivered to the CVP and SWP could be affected because of the change in the monthly pumping pattern resulting from EWA Actions. When pumping is reduced by EWA actions in the winter and spring months, the CVP/SWP forego pumping water that has relatively low chloride and bromide concentrations, with the exception of the higher chloride and bromide concentrations occurring in December and January (Figure 5-2 and Figure 5-4). To pay back the CVP/SWP projects for all or a portion of the water lost due to the pumping reductions, DWR and Reclamation would increase project pumping during July through September, when the chloride and bromide concentrations in the Delta generally are higher than the chloride and bromide concentrations during winter and spring months. However, it is difficult to generalize about seasonal trends because depending on the specific month in a season, these trends are not necessarily accurate. For example, median chloride and bromide concentrations in July are lower than median concentrations in December and January, and median chloride and bromide concentrations in August are similar to those occurring in January (Figure 5-2 and Figure 5-4). As a result, changes in the monthly pumping pattern under the EWA Program have the potential to result in water of higher chloride concentrations being delivered to the CVP and SWP water users south of the Delta during months of increased pumping, resulting in more total salts being delivered to these water users over an annual period (total annual salt load). For this reason, a quantitative analysis of the total annual chloride load and total annual bromide load was conducted in order to determine whether or not changes in the monthly pumping pattern would result in an increase in the total annual salt load delivered to CVP and SWP water users in south of the Delta.

Using the assumptions discussed above and detailed in Attachment 1, monthly average chloride and bromide loading (in tons) at CVP/SWP export locations (Tracy Pumping Plant and Banks Pumping Plant) occurring under the Baseline Condition and under the Flexible Purchase Alternative were calculated. The period of record modeled for the Baseline Condition and Flexible Purchase Alternative is the 15-year period of record extending from 1979-1993.

Organic carbon was analyzed separately because its seasonal distribution pattern varies from that of salinity and bromide, as detailed in Section 5.1.5.2.1. The response of organic carbon to EWA transfers was assessed qualitatively in the absence of modeling tools that allow quantitative prediction of organic carbon behavior and distribution. The likely outcome of altering timing of pumping under the EWA Program was assessed by providing information regarding current organic carbon concentrations and conceptually evaluating the potential changes that may occur when timing of export pumping would be altered for the EWA Program.

5.2.1.2 Crop Idling

EWA acquisitions obtained through crop idling could result in alterations to water quality through temporary conversion of lands from rice or cotton crops to bare fields. Bare fields may result in increased potential for sediment transport via wind erosion and subsequent deposition onto surface waterbodies, thus potentially affecting water quality directly. It is possible that farmers may plant dry crops or cover crops, which would not result in conversion of lands to bare fields. However, this effects analysis assumed that idled fields would be bare because bare fields represent the scenario under which it is most likely that the greatest effects to water quality could occur. The assessment methodology described below was used to evaluate the potential effects to water quality associated with wind erosion and sediment deposition potentially resulting from temporary conversion of lands from rice or cotton crops to bare fields. Additionally, because idling involves cessation of irrigation, EWA acquisitions obtained through crop idling also could result in alterations to water quality through changes in the timing and quantity of water applied to the land. Changing the timing and quantity of water applied to the land could result in changes to the amount of leaching of water quality constituents, including pesticides, fertilizers, salts, and metals.

To assess the potential effects to water quality resulting from temporary conversion of lands from rice crops to bare fields, the change in sediment transport via wind erosion under the EWA Program alternatives as compared to the Baseline Condition was evaluated. The assessment methods used to determine the change in sediment transport via wind erosion resulting from idling as described under the EWA Program alternatives is detailed for the assessment methods used to evaluate sediment transport resulting from the EWA Program alternatives as compared to the Baseline Condition. In order to assess the potential effects to water quality associated with changes in the timing and quantity of water applied to the land, a qualitative description of the changes in timing and quantity of water applied to the land under the EWA Program alternatives as compared to the Baseline Condition was provided. Potential effects to water quality occurring under the EWA Program alternatives as compared to the Baseline Condition were assessed by conceptually comparing the leaching potential, with respect to timing and quantity of water applied, under the EWA Program alternative to the leaching potential under the Baseline Condition.

Making a fully quantitative, reliable analysis of potential sediment mobilization and of fate and transport of water quality constituents under differing water application regimes requires highly complex, data intensive, site-specific data collection and modeling effort that is not practical at this level. Therefore, the methodologies described above were used to assess potential effects to water quality resulting from crop idling.

5.2.1.3 Stored Groundwater Purchase

EWA acquisitions could be obtained through stored groundwater purchase in the American River basin and the Tulare Lake Subbasin. Because groundwater banking in the American River basin is in its infancy, EWA acquisitions obtained via stored groundwater purchases in the American River basin are the same, mechanistically, as EWA acquisitions obtained through groundwater substitution, and are therefore evaluated as groundwater substitution in Section 5.2.5.4.

EWA acquisitions could be obtained through stored groundwater purchases from Kern County Water Agency in the Kern subbasin. If stored groundwater is purchased from the Kern subbasin, it would either be used in the Kern subbasin or it would be pumped directly into the California Aqueduct. Because the Kern subbasin is a closed system and has no drainage outlet for surface or groundwater, purchased stored groundwater used in the Kern subbasin would return to the Kern subbasin as groundwater. Because the potential effects to groundwater quality associated with stored groundwater purchases under the EWA Program alternatives are already detailed in the Groundwater section of this EIS/EIR (Chapter 6), and because potential effects were determined to be less than significant, in part due to the local monitoring and mitigation required by the groundwater mitigation measure, an additional redundant assessment of use of purchased stored groundwater in the Kern subbasin was not deemed warranted. See Chapter 6, Groundwater, of this EIS/EIR for additional detail regarding the potential effects associated with stored groundwater purchases under the EWA Program.

EWA acquisitions obtained through stored groundwater purchases from the Kern subbasin banking projects and conveyed directly into the California Aqueduct have the potential to affect water quality in the California Aqueduct. In the California Aqueduct, monitoring data show that TDS concentrations are lower in wet years and higher in dry years. Water quality in the California Aqueduct also has been reduced over time because of increased volumes of irrigation runoff inflow, which may contain elevated salinity levels. EWA acquisitions from groundwater substitution have the potential to influence water quality in the California Aqueduct by introducing new or increased quantities of existing constituents of concern (initially present in groundwater and pumped to the surface) into the water flowing through the California Aqueduct. EWA acquisitions from stored groundwater purchases in the Export Service Area may be conveyed directly into the California Aqueduct. In order to assess the potential effects to water quality resulting from the direct conveyance of purchased stored groundwater to the California Aqueduct, a description of the water quality criteria used by DWR for acceptance of non-Project water into the California Aqueduct was provided. Potential effects to water quality occurring under the EWA Program alternatives as compared to the Baseline Condition were assessed by evaluating whether the acceptance criteria would be exceeded under the EWA Program alternatives.

5.2.1.4 Groundwater Substitution

EWA acquisitions obtained through groundwater substitution could result in alterations to water quality through mixing of groundwater and surface water following application of groundwater to agricultural fields for irrigation. Mixing of groundwater and surface water may alter water quality constituent concentrations in agricultural drainage, which potentially could affect the water quality in rivers due to irrigation return flows. EWA acquisitions obtained through groundwater substitution could also result in alterations to water quality indirectly through changes in river flows and water surface elevation during reservoir hold-back periods when farmers participating in EWA Program groundwater substitution are not utilizing their surface water allotment. Potential water quality effects associated with EWA acquisition from groundwater substitution resulting from changes in river flows and surface water elevation in project reservoirs were assessed in Section 5.2.5.1 because the assumptions used in the hydrologic modeling conducted for this analysis account for EWA acquisitions by groundwater substitution (see Attachment 1). Potential alterations in river flows and reservoir water surface elevations for waterbodies located in basins where groundwater substitution could occur are addressed in Section 5.2.5.1.

Potential effects to water quality resulting from application of groundwater to agricultural fields was assessed using qualitative descriptions of the application of groundwater to fields under the EWA Program alternatives relative to the Baseline Condition. Potential effects to water quality occurring under the EWA Program alternatives as compared to the Baseline Condition were assessed by conceptually comparing the dilution potential under the EWA Program alternatives to the dilution potential under the Baseline Condition. Fully quantitative assessments of groundwater effects and groundwater-surface water interactions are often speculative, and rely heavily on calculations, modeling and qualitative interpretations of data, without sufficient supporting direct measurement and observation. Therefore, the methodologies described above were used to assess potential effects to water quality resulting from groundwater substitution.

5.2.1.5 Source Shifting

EWA acquisitions obtained through source shifting may result in alterations to water surface elevation in reservoirs used by the EWA Program (San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake). Reducing water surface elevation may affect water quality within these reservoirs. In order to assess whether implementation of the EWA Program alternatives would result in effects to water quality from water surface elevation reductions in San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake, a qualitative description of expected water surface elevation reductions under the EWA Program alternatives and under the Baseline Condition were provided for each evaluated reservoir. Potential effects to water quality occurring under the EWA Program alternatives, as compared to the Baseline Condition, were assessed by conceptually comparing the water surface elevation in these reservoirs under EWA Program alternatives to the water surface elevations under the Baseline Condition and assessing whether alterations in water surface elevation resulting from implementation of the EWA Program alternatives would adversely affect designated beneficial uses, exceed existing regulatory standards, or substantially degrade water quality.

5.2.2 Environmental Measures Incorporated into the Project

EWA agencies have incorporated the following measures into the project to continue with standard Project operating procedures and to improve the water quality to users south of the Delta and in the Export Service Area.

1. Carriage water will be used to protect and maintain chloride concentrations in the Delta. (Further discussed in Section 5.2.2.1.)

2. EWA agencies will only purchase water if it meets all of the required provisions of DWR's acceptance criteria governing conveyance of non-Project water through the California Aqueduct. (Further discussed in Section 5.2.2.2.)

5.2.2.1 Carriage Water

Carriage water[2] is an increase in Delta outflow that protects Delta water quality and maintains chloride concentrations at levels that would be equivalent to those under the Baseline Condition. Carriage water is currently used to increase Delta outflow and to protect and maintain Delta water quality. DWR and Reclamation historically charged entities a flat 20 percent carriage water charge for water purchased upstream from the Delta and conveyed through the CVP/SWP pumps to the south of Delta SWP/CVP water users during the summer months. For example, if an entity, in this case the EWA, wanted to pump 80 acre-feet, the entity would have to buy 100 acre-

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[2] Increases in Delta chloride concentrations due to increases in CVP and SWP pumping from the south Delta could occur when the total pumping is greater than the flows into the central and south Delta, less the in-Delta agricultural uses in the central and south Delta. Flows into the central and south Delta include flows from the Sacramento River into the central Delta through the CVP Delta Cross Channel facility and Georgiana Slough; flows from eastside streams such as the Mokelumne, Cosumnes, and Calaveras rivers; and flows from the San Joaquin River. When the total SWP and CVP pumping exceeds the total inflow to the central and south Delta, less agriculture uses in the central and south Delta, the difference must come from the Sacramento River via three Mile Slough or around the western end of Sherman Island. When CVP and SWP pumping exceeds the total of inflow to the central and south Delta less agriculture uses in the central and south Delta, ocean salts move upstream in the lower San Joaquin River resulting in an increase in salinity in the Central and South Delta and at the CVP and SWP pumping plants. Thus, increased pumping in summer months to pump EWA pay-back water thought the Delta has the potential to cause increased chloride concentrations in the Delta. However, carriage water, which is an increase in Delta outflow used to maintain chloride concentrations at pre-increased CVP/SWP levels, allows the maintenance of chloride concentrations during increased pumping in the summer months, as described above.

feet. The 100 acre-feet would be provided as inflow to the Delta and 20 acre-feet of the transfer would be used to increase Delta outflow to ensure that chloride concentrations would not increase due to the 80 acre-feet of increased pumping. In the last two years, Reclamation and DWR have developed a way to use DSM2 on a real time basis to estimate the amount of carriage water needed in that year to pump EWA water (or any other water supply including SWP water users, the CVP, and other entities purchasing water upstream from the Delta) without causing an increase in chloride concentration in the Delta. DWR's and Reclamation's work the past two years indicate that the carriage water required to protect Delta water quality can range from 15 to 25 percent or more. Given these newly developed techniques, the EWA can purchase water upstream from the Delta, but for every acre-foot purchased, 15 to 25 percent or more of that acre-foot would be dedicated to increase Delta outflow. The remainder would be pumped at the CVP/SWP pumping plants to ensure, at a minimum, no net increase in chloride concentrations within the Delta would occur due to the EWA Program. During past EWA water transfers involving changes in the timing of CVP/SWP exports, carriage water has provided the mechanism necessary to maintain water quality in the Delta.

5.2.2.2 California Aqueduct Pump-in Quality

DWR has developed acceptance criteria to govern the water quality of non-Project water (groundwater) conveyed through the California Aqueduct. In accordance with the Water Code and DWR's acceptance criteria, non-Project water may be conveyed, wheeled, or transferred in the SWP provided that water quality is protected (DWR 2001a). Therefore, groundwater supplied to the California Aqueduct through groundwater substitution under the Flexible Purchase Alternative would only be purchased by EWA and accepted by the SWP if the non-Project water met all of the required provisions of the acceptance criteria.

General provisions for the acceptance criteria under this agreement include:

- The proponent of any non-Project water input proposal shall demonstrate that the water is of consistent, predictable and acceptable quality;

- The DWR shall consider all non-Project water input proposals based upon the criteria established in the acceptance criteria;

- DWR will consult with the SWP contractors and the Department of Health Services on drinking water quality issues relating to non-Project water as needed to assure the protection of SWP water quality;

- Nothing stated in the acceptance criteria shall be considered as authorizing the objectives of Article 19 of the water supply contracts or drinking water maximum contaminant levels to be exceeded; and

- These criteria shall not constrain DWR's ability to operate the SWP for its intended purposes or to protect its integrity during emergencies. There shall not be any adverse impacts to SWP water deliveries, operations, or facilities.

Under the general provisions, DWR will use a two-tier approach for accepting non-Project water into the California Aqueduct. Tier 1 programs have a "no adverse impact" criteria and shall be tied to historical water quality levels in the California Aqueduct. Programs meeting Tier 1 criteria shall be approved by DWR. Tier 2 programs have water quality levels that exceed the historical water quality levels in the California Aqueduct and have potential to cause adverse effects to State water contractors. Tier 2 programs shall be referred to a State water contract facilitation group for review. The facilitation group would review the program and, if needed, make recommendations to DWR to use during consideration of the project (DWR 2001a).

DWR monitors water quality in the California Aqueduct to ensure that SWP water quality meets Department of Health Services drinking water standards and Article 19 Water Quality Objectives for long-term SWP contracts. The objective of the SWP water quality monitoring program is to maintain project water at a quality acceptable for recreation, agriculture, and public water supply for the present and future, under a policy of multiple uses of the facilities. Recreational uses of SWP facilities included fishing, boating, and water contact sports. The Department analyzes the water for physical parameters such as water temperature, specific conductance, turbidity, and more than 60 other chemical constituents including inorganic chemicals, pesticides, and organic carbon. Under Tier 1, all constituents of non-Project water shall not exceed the historical water quality levels measured at the O'Neill Forebay Outlet (formerly Check 13) on the SWP as measured by DWR's water quality monitoring program (Table 5-32 and Table 5-33) (DWR 2001a).

Table 5-32
Historical Water Quality Conditions 1988-2001 at O'Neill Forebay Outlet (mg/L)

Metals, Minerals and Others					
	Mean	***Min***	***Max***	***Stand Dev***	***Count***
Aluminum	0.029	0.004	0.527	0.050	137
Antimony	0.005*	0.005*	0.005*	0.000	10
Arsenic	0.002	0.001	0.004	0.000	215
Barium	0.050	0.037	0.068	0.002	139
Beryllium	0.001*	0.001*	0.001*	0.000	11
Bromide	0.21	0.05	.54	0.11	121
Cadmium	0.004	0.001*	0.005	0.002	139
Chromium	0.005*	0.005*	0.011	0.001	189
Copper	0.005	0.001*	0.028	0.003	214
Fluoride	0.09	0.01*	0.40	0.05	225
Iron	0.049	0.005	0.416	0.058	214
Manganese	0.007	0.003	0.06	0.004	17
Mercury	0.0008	0.0002*	0.0010	0.0004	163
Nickel	0.002	0.001*	0.004	0.001	11
Nitrate	3.5	0.6	9.6	1.8	192
Nitrate-Nitrite	0.6	0.1	1.2	0.3	22
Nitrite	0.5	0.3	1.1	0.2	21
Selenium	0.001	0.001*	0.001*	0	208
Silver	0.004	0.001*	0.005	0.002	139

Table 5-32 Historical Water Quality Conditions 1988-2001 at O'Neill Forebay Outlet (mg/L)					
Metals, Minerals and Others					
	Mean	***Min***	***Max***	***Stand Dev***	***Count***
Sulfate	43	16	99	15	228
Total Organic Carbon	4	3	10	2	131
Zinc	0.009	0.005*	0.210	0.016	206

Source: DWR 2001.
* These values represent reporting limits, actual values would be lower.
Pesticides, herbicides and synthetic organic chemicals are not detected in water samples at this location. Therefore, historical conditions are considered to be represented by less than detection levels for these compounds.

Table 5-33 Salinity Criteria 1979-2000 (Specific Conductance, us/cm)												
Year Type*	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***
Wet	454	401	393	363	355	351	338	340	299	302	350	343
Near Normal*	474	430	511	302	415	520	462	371	430	474	528	623
Dry	566	510	472	469	403	424	441	486	613	498	715	495
Critical	673	728	642	578	548	597	586	609	648	668	604	756

* Year type is based on water year classification; below normal and above normal have been combined into one designation as near normal.

As stated in the acceptance criteria, "*Blending of multiple water sources prior to inflow into the SWP is acceptable. As part of the non-Project water proposal, water may be introduced into the aqueduct that by itself might cause the ambient baseline to be exceeded, provided that the sum total of all introduced water from a defined project do not exceed the historical baseline for the Aqueduct on an instantaneous flow weighted basis. Blending (mixing) within the aqueduct must be between and cannot overlap any active municipal and industrial delivery locations, without approval of DWR. The proponent shall demonstrate by model or an approach acceptable to DWR and the State water contractor facilitation group, that the water is adequately mixed before reaching the first M&I customer*" (DWR 2001a).

Non-Project water proposals meeting Tier 1 water quality standards shall be approved by DWR without further review by other agencies except as required by law. However, upon approval by DWR of any pumping under Tier 1, the State water contractor facilitation group will be notified by DWR of the action.

Non-Project water exceeding Tier 1 standards or contributing to aqueduct levels that exceed the historical water quality baseline may be considered for input into the SWP on a case-by-case basis by the SWP contractors and DWR. Proposals that would affect SWP water quality delivered to downstream State water contractors will be reviewed by State water contractors. The intent is that proposals that produce an overall net water quality benefit will be approved (DWR 2001a).

A State water contractor non-Project inflow facilitation group will be established and will review all requests for non-Project inflow that do not meet the Tier 1 water quality criteria. This group will consist of representatives from each State water contractor, that chooses to participate. DWR may also participate as an observer. The group will consider the merits, effects, mitigation, cost/benefit ratio and other issues of each Tier 2 non-Project water proposal and provide recommendations to DWR. A consensus recommendation from the facilitation group would be sought regarding a potential exceedance of the historical water quality levels. In the absence of consensus from the facilitation group, DWR will base its decision on the merits of the program and its ability to provide overall benefits to the SWP (DWR 2001a).

Following input from the group, DWR will then consider the facilitation group and any individual SWP contractor recommendations in reviewing the proposal. DWR will make the final decision to approve, modify or deny the non-Project water proposal. Any decision must be in compliance with the law and existing contracts. Once a program for delivery of non-Project water to the Aqueduct has been approved, an annual review of the program will occur by DWR and the State water contractors. As needed, DWR, DHS or State water contractors may recommend changes or additions to these water quality criteria governing non-Project water proposals. Proposed changes or additions will be reviewed by the facilitation group prior to consideration by DWR (DWR 2001a).

5.2.3 Significance Criteria

Table 5-34 lists the effects indicators and significance criteria developed for use in assessing the significance of potential effects upon water quality that may result from implementation of EWA Program alternatives.

Table 5-34
Water Quality Impact Indicators and Significance Criteria for EWA Actions

Impact Indicators	***Significance Criteria***
Stored Reservoir Water (including stored water acquired from crop idling and groundwater substitution)	
CVP/SWP Project Reservoirs Within the Upstream from the Delta Region	
Lake Shasta/Lake Oroville/Folsom Reservoir	
End-of-month reservoir water surface elevation (feet/msl) occurring for each month of the year.	Decrease in reservoir water surface elevation, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 72-year period of record.
End-of-month storage (TAF) for each month of the year.	Decrease in reservoir storage, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 72-year period of record.
Rivers Within the Upstream from the Delta Region	
Sacramento River	
Monthly mean flow (cfs) below Keswick Dam and at Freeport for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 72-year period of record.
Monthly mean water temperature (°F) at Bend Bridge and Freeport for each month of the year.	Increase in water temperature, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 69-year period of record.

Table 5-34
Water Quality Impact Indicators and Significance Criteria for EWA Actions

Impact Indicators	Significance Criteria
Lower Feather River	
Monthly mean flow (cfs) below the Thermalito Afterbay Outlet and at the mouth of the Feather River for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 72-year period of record.
Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet and at the mouth of the Feather River for each month of the year.	Increase in water temperature, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 69-year period of record.
Lower Yuba River	
Mean daily flows (cfs) occurring at the USGS (Marysville and Smartville) gages for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the period of record.
Mean daily water temperatures (°F) at the USGS (Marysville and Daguerre Point Dam) gages for each month of the year.	Increase in water temperature, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the period of record.
Middle Fork American River	
Monthly median flows below Ralston Afterbay for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the period of record.
Lower American River	
Monthly mean flow (cfs) below Nimbus Dam, below Watt Avenue, and at the mouth of the American River for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 72-year period of record.
Monthly mean water temperature (°F) below Nimbus Dam, below Watt Avenue, and at the mouth of the American River for each month of the year.	Increase in water temperature, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 69-year period of record.
Merced River	
Monthly mean flow (cfs) below Crocker-Huffman Dam and at the mouth of the Merced River for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 72-year period of record.
San Joaquin River	
Monthly mean flow (cfs) at the confluence of the Merced River and at Vernalis for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the 72-year period of record.

Table 5-34 Water Quality Impact Indicators and Significance Criteria for EWA Actions	
Impact Indicators	***Significance Criteria***
Non-Project Reservoirs Within the Upstream from the Delta Region	
Little Grass Valley Reservoir/Sly Creek Reservoir/New Bullards Bar Reservoir/French Meadows Reservoir/Hell Hole Reservoir/ Lake McClure	
Median reservoir storage (TAF) and median water surface elevation (feet/msl) occurring each month of the year.	Decrease in median reservoir storage or median water surface elevation, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period over the historical period of record.
Sacramento-San Joaquin Delta Region	
Chloride, bromide, and organic carbon concentrations within the Delta during months of increased pumping.	Alteration in the chloride, bromide, and organic carbon concentrations within the Delta during months of increased pumping resulting in an increase in chloride, bromide or organic carbon, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for the July through September period.
Annual total chloride, bromide, and organic carbon load delivered to CVP and SWP water users.	Increase in the annual salt and organic carbon load delivered to CVP and SWP water users, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality for any month of the annual period.
Crop Idling	
Sediment transport due to wind erosion.	Increase in sediment transport, resulting in sediment deposition in surrounding waterbodies, due to wind erosion, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality.
Timing and quantity of water applied to the land.	Change in the timing and quantity of water applied to the land, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to decrease the physiochemical qualities of surface water resulting in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality.
Stored Groundwater Purchase	
Export Service Area	
DWR/SWP non-Project water acceptance criteria.	Exceedance of Tier 1 and Tier 2 water quality standards resulting in a deterioration in the physiochemical qualities of water in the California Aqueduct resulting from an input of stored groundwater, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality.
Groundwater Substitution	
Groundwater applied to agricultural fields.	Deterioration in the physiochemical qualities of surface runoff, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term to result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality.

Table 5-34 Water Quality Impact Indicators and Significance Criteria for EWA Actions	
Impact Indicators	**Significance Criteria**
Source Shifting	
Export Service Area Reservoirs (San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake)	
Water surface elevation.	Decrease in water surface elevation, relative to the basis of comparison, of sufficient magnitude and frequency over the long-term, to adversely affect designated beneficial uses, exceed existing regulatory standards or substantially degrade water quality.

5.2.4 Environmental Consequences/Environmental Impacts of the No Action/No Project Alternative

The California Environmental Quality Act (CEQA) basis for comparison is defined as the Affected Environment/Existing Condition. It is anticipated that if the EWA were not implemented, actions to protect water quality would continue under existing regulatory requirements. DWR and Reclamation would continue to attempt to re-operate the SWP and CVP, respectively, to avoid decreased deliveries to export users. These actions are described in Chapter 2.

There would be no variation in the reservoir storage levels, river flows, or water temperatures under the No Action/No Project Alternative, as described for the Affected Environment/ Existing Condition. As such, water quality under the No Action/No Project Alternative would exhibit the same range of constituent levels and be subject to the same environmental, riverine, and oceanic influences and variations (e.g., tidal currents, wind patterns, oceanic inflow, climatic variations, water supply operations, and established inland flow regimes) that already are present under the Affected Environment/Existing Condition. Further, there would be no variation in the existing range of timing, magnitude and duration of actions occurring under the No Action/No Project Alternative, as compared to the Affected Environment/ Existing Condition. Therefore, there would be no water quality effects associated with No Action/No Project Alternative.

As described in the above paragraphs, the Affected Environment and the No Action/No Project Alternative are the same; therefore, they are collectively referred to as the Baseline Condition in the following sections.

5.2.5 Environmental Consequences/Environmental Impacts of the Flexible Purchase Alternative

The Flexible Purchase Alternative allows asset acquisition of up to 600,000 acre-feet[3] and does not specify transfer limits in the Upstream from the Delta Region or the Export Service Area. Total transfers made in the Upstream from the Delta Region would range from 50,000 to 600,000 acre-feet, limited by hydrologic year and conveyance capacity through the Delta. Although potential transfers would not all

[3] Flexible Purchase Alternative acquisition amount includes all variable assets except Export/Inflow Ratio. (Refer to Section 2.4.2.2 for description of variable assets.)

occur in one year, this section discusses maximum transfers to the EWA from all agencies (a transfer amount that would result in greater than 600,000 acre-feet) to provide an effect analysis of a maximum transfer scenario. Similarly, the evaluation includes an analysis of up to 540,000 acre-feet from the Export Service Area to cover a maximum transfer scenario for that region.

The analysis provides an evaluation of the Flexible Purchase Alternative as compared to the Baseline Condition. The impact indicators selected to evaluate the resource topics represent the potential effect issues. A discussion for each effect issue is presented for the alternative. The anticipated change that would occur under each scenario is compared to the significance criteria to ascertain whether the EWA Program alternative would result in "*beneficial*," "*less-than-significant*," or "*significant*" impacts on water quality. Appendix G, Water Quality Technical Appendix, presents a detailed discussion of the changes in the Flexible Purchase Alternative compared to the Baseline Condition.

5.2.5.1 Stored Reservoir Water (Including Stored Water Acquired from Crop Idling and Groundwater Substitution)

5.2.5.1.1 CVP/SWP Reservoirs Within the Upstream from the Delta Region

Lake Shasta

EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter surface water elevation and reservoir storage in Lake Shasta, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, long-term average end-of-month water surface elevation and storage in Lake Shasta would remain essentially equivalent to the Baseline Condition during every month of the year. Table 5-35 and Table 5-36 show the long-term end-of-month surface elevation and storage differences for the flexible purchase alternative compared to the Baseline Condition. The long-term average end-of-month water surface elevation in Lake Shasta would not decrease by more than 1 foot in any of the months included in the analysis. Long-term end-of-month storage would not change by more than 0.6 percent.

Table 5-35 Long-term Average Lake Shasta End-of-Month Elevation Under the Baseline Condition and Flexible Purchase Alternative			
Month	Average Elevation[1] (feet msl)		
	Baseline Condition	Flexible Purchase Alternative	Difference
Jan	998	998	0
Feb	1011	1011	0
Mar	1027	1027	0
Apr	1037	1037	0
May	1036	1036	0
Jun	1024	1024	0
Jul	1001	1001	0
Aug	984	983	-1
Sep	977	977	0
Oct	973	972	0
Nov	977	977	0
Dec	985	985	0

[1] Based on 72 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table 5-36 Long-term Average Lake Shasta End-of-Month Storage Under the Baseline Condition and Flexible Purchase Alternative				
Month	Average Storage[1] (TAF)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(TAF)	(%)[2]
Jan	2914	2914	0	0.0
Feb	3184	3184	0	0.0
Mar	3544	3544	0	0.0
Apr	3793	3793	0	0.0
May	3780	3780	0	0.0
Jun	3495	3495	0	0.0
Jul	3018	2999	-19	-0.6
Aug	2655	2645	-10	-0.4
Sep	2511	2510	-1	0.0
Oct	2432	2432	0	0.0
Nov	2509	2509	0	0.0
Dec	2672	2672	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

In addition to an evaluation of average end-of-month surface elevation and storage differences over the projected EWA project time, end-of-month surface elevation and storage differences were evaluated under critical year, dry year and below normal year conditions. The results are presented in Table 5-37.

Table 5-37
Lake Shasta End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years

	Water Surface Elevation				Reservoir Storage			
	Largest Increase	Percent Difference	Largest Decrease	Percent Difference	Largest Increase	Percent Difference	Largest Decrease	Percent Difference
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(%)	(TAF)	(%)
Critical	0.4	0.05%	-2.3	-0.26%	4.4	0.44%	-28	-2.6%
Dry	0.3	0.03%	-1	-0.11%	5	0.2%	-15	-0.9%
Below Normal	0.7	0.07%	-1.3	-0.13%	14	0.6%	-30	-1%

Overall, Lake Shasta end-of-month water surface elevation and reservoir storage under the Flexible Purchase Alternative would be essentially equivalent to or greater than end-of-month water surface elevation and reservoir storage under the Baseline Condition. Therefore, implementation of the Flexible Purchase Alternative would not adversely affect concentrations of water quality constituents or water temperatures in Lake Shasta. As a result, any differences in water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect water quality in such a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality in Lake Shasta would be less than significant.

Lake Oroville

EWA acquisition of Feather River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter surface water elevations or reservoir storage in Lake Oroville, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, the long-term average end-of-month water surface elevation and storage in Lake Oroville would remain essentially equivalent to or greater than the Baseline Condition during most months of the year. Tables 5-38 and 5-39 show the long-term end-of-month elevation and storage differences for the flexible purchase alternative compared to the Baseline Condition.

Table 5-38
Lake Oroville End-of-Month Elevation Under the Baseline Condition and Flexible Purchase Alternative

Month	Average Elevation[1] (feet msl)		
	Baseline Condition	Flexible Purchase Alternative	Difference
Jan	807	807	0
Feb	824	824	0
Mar	840	840	0
Apr	857	857	0
May	864	866	2
Jun	849	852	3
Jul	825	821	-4
Aug	794	791	-3
Sep	782	782	0
Oct	775	775	0
Nov	780	780	0
Dec	791	791	0

[1] During 72 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1, Assessment Methods.

Table 5-39
Long-term Average Lake Oroville End of Month Storage Under the Baseline Condition and Flexible Purchase Alternative

Month	Average Storage[1] (TAF)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(TAF)	(%)[2]
Jan	2350	2350	0	0.0
Feb	2525	2525	0	0.0
Mar	2704	2704	0	0.0
Apr	2953	2953	0	0.0
May	3056	3073	17	0.6
Jun	2849	2888	39	1.4
Jul	2557	2507	-50	-2.0
Aug	2218	2192	-26	-1.2
Sep	2105	2103	-2	-0.1
Oct	2047	2047	0	0.0
Nov	2099	2099	0	0.0
Dec	2199	2199	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

In addition to an evaluation of average end-of-month surface elevation and storage differences over the projected EWA project time, end-of-month surface elevation and storage differences were evaluated under critical year, dry year and below normal year conditions. Tables 5-40 summarizes the results.

Table 5-40
Lake Oroville End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years

	Water Surface Elevation				Reservoir Storage			
	Largest Increase	*Percent Difference*	*Largest Decrease*	*Percent Difference*	*Largest Increase*	*Percent Difference*	*Largest Decrease*	*Percent Difference*
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(%)	(TAF)	(%)
Critical	10	1.3%	-7	-1%	92	6%	-52	-4%
Dry	6	0.7%	-5	-0.6%	77	3.1%	-50	-2.3%
Below Normal	3	0.3%	-4	-0.5%	40	1.3%	-53	-2.1%

Overall, Lake Oroville end-of-month water surface elevation and reservoir storage under the Flexible Purchase Alternative would not be substantially less than end-of-month water surface elevation and reservoir storage under the Baseline Condition. Therefore, implementation of the Flexible Purchase Alternative would not adversely affect concentrations of water quality constituents or water temperatures in Lake Oroville. As a result, any differences in water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be less than significant.

Folsom Reservoir

EWA acquisition of American River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter surface water elevation and reservoir storage in Folsom Reservoir, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, the long-term average end-of-month water surface elevation and storage in Folsom Reservoir would remain essentially equivalent to the Baseline Condition during every month of the year. Table 5-41 and Table 5-42 show the long-term end-of-month elevation and storage differences for the flexible purchase alternative compared to the Baseline Condition. Under the Flexible Purchase Alternative, the end-of-month water surface elevation and storage in Folsom Reservoir would be essentially equivalent to or greater than the Baseline Condition for 863 months of the 864 months included in the analysis.

Table 5-41
Long-term Average Folsom Reservoir End-of-Month Elevation Under the Baseline Condition and Flexible Purchase Alternative

Month	Average Elevation[1] (feet msl)		
	Baseline Condition	Flexible Purchase Alternative	Difference
Jan	411	411	0
Feb	414	414	0
Mar	425	425	0
Apr	438	438	0
May	449	449	0
Jun	444	444	0
Jul	428	427	-1
Aug	421	420	-1
Sep	411	411	0
Oct	409	409	0
Nov	407	407	0
Dec	408	408	0

[1] Based on 72 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table 5-42
Long-term Average Folsom Reservoir End-of-Month Storage Under the Baseline Condition and Flexible Purchase Alternative

Month	Average Storage[1] (TAF)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(TAF)	(%)[2]
Jan	473	473	0	0.0
Feb	495	495	0	0.0
Mar	584	584	0	0.0
Apr	703	703	0	0.0
May	815	815	0	0.0
Jun	769	769	0	0.0
Jul	626	622	-4	-0.6
Aug	568	565	-3	-0.5
Sep	488	488	0	0.0
Oct	469	469	0	0.0
Nov	451	451	0	0.0
Dec	457	457	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

In addition to an evaluation of average end-of-month surface elevation and storage differences over the projected EWA project time, end-of-month surface elevation and storage differences were evaluated under critical year, dry year and below normal year conditions. Table 5-43 summarizes the results.

Table 5-43 Folsom Reservoir End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years								
	Water Surface Elevation				Reservoir Storage			
	Largest Increase	Percent Difference	Largest Decrease	Percent Difference	Largest Increase	Percent Difference	Largest Decrease	Percent Difference
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(%)	(TAF)	(%)
Critical	0	0	-1	-0.2%	0	0	-3	-0.1%
Dry	0	0	-0.4	-0.1%	0	0	-3	-0.8%
Below Normal	0	0	-0.4	-0.1%	0	0	-4	-0.6%

Overall, Folsom Reservoir end-of-month water surface elevation and reservoir storage under the Flexible Purchase Alternative would be essentially equivalent to or greater than end-of-month water surface elevation and reservoir storage under the Baseline Condition. Therefore, implementation of the Flexible Purchase Alternative would not adversely affect concentrations of water quality constituents or water temperatures in Folsom Reservoir. As a result, any differences in water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be less than significant.

5.2.5.1.2 Non-Project Reservoirs Within the Upstream from the Delta Region

Little Grass Valley and Sly Creek Reservoirs

EWA acquisition of OWID stored reservoir water would reduce surface water elevation and reservoir storage in Little Grass Valley and Sly Creek reservoirs, relative to the Baseline Condition.

Table 5-44 provides monthly median reservoir storage and water surface elevation for Little Grass Valley Reservoir. Reductions in median reservoir storage would range from 3 percent in April to 24 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Reductions in median water surface elevation would range from 2 feet in April to 12 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

Table 5-44 Little Grass Valley Reservoir Monthly Median Storage, and Water Surface Elevation Under the Baseline Condition and Flexible Purchase Alternative							
	Storage				Elevation		
Month	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	52	52	0	0	5018	5018	0
Nov	50	44	-6	-12	5015	5010	-6
Dec	50	38	-12	-24	5016	5004	-12
Jan	57	48	-10	-17	5022	5013	-9
Feb	63	55	-7	-11	5027	5021	-6
Mar	70	65	-5	-7	5033	5029	-4
Apr	76	73	-2	-3	5037	5035	-2
May	86	86	0	0	5044	5044	0
Jun	86	86	0	0	5044	5044	0
Jul	76	76	0	0	5037	5037	0
Aug	66	66	0	0	5029	5029	0
Sep	58	58	0	0	5023	5023	0

Based on median monthly storage and flow over the historical record from 1970 to 2001.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

In Little Grass Valley Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of median reservoir storage and median water surface elevation from the months of November through April as compared to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in similar reductions than those of the critical year. Table 5-45 summarizes reductions in water surface elevation and reservoir storage in Little Grass Valley reservoir in critical and dry and below normal years, compared to the Baseline Condition.

Table 5-45 Little Grass Valley Reservoir End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years						
	Water Surface Elevation Reductions				Reservoir Storage Reductions	
	Largest Reduction	Percent Difference	Smallest Reduction	Percent Difference	Largest Reduction	Smallest Reduction
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(TAF)
Critical	-12	-24%	-2	-3%	-12	-2
Dry and Below Normal	-12	-24%	-2	-3%	-12	-2

In Sly Creek Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage and water surface elevation from the months of November through April as compared to the Baseline Condition (Table 5-46). Reductions in median reservoir storage would range from 2 percent in April to 27 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Reductions in median water surface elevation would range from 2 feet in April to 18 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

Table 5-46
Sly Creek Reservoir Monthly Median Storage and Elevation
Under the Baseline Condition and Flexible Purchase Alternative

Month	Storage				Elevation		
	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	22	22	0	0	3438	3438	0
Nov	21	18	-3	-12	3434	3425	-8
Dec	19	14	-5	-27	3427	3410	-18
Jan	27	23	-4	-15	3453	3441	-12
Feb	36	33	-3	-8	3476	3468	-8
Mar	48	46	-2	-4	3504	3500	-4
Apr	55	54	-1	-2	3521	3519	-2
May	62	62	0	0	3536	3536	0
Jun	58	58	0	0	3525	3525	0
Jul	48	48	0	0	3504	3504	0
Aug	33	33	0	0	3469	3469	0
Sep	25	25	0	0	3447	3447	0

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Hydrologic conditions under the Flexible Purchase Alternative during critical and dry and below normal years would result in reduction of median reservoir storage for the months of November through April as compared to the Baseline Condition. The largest reductions would occur during December and the smallest during April, relative to the Baseline Condition. Table 5-47 summarizes reductions in water surface elevation and reservoir storage in Sly Creek Reservoir in critical and dry and below normal years, compared to the Baseline Condition.

Table 5-47
Sly Creek Reservoir End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years

	Water Surface Elevation Reductions				Reservoir Storage Reductions	
	Largest Reduction	Percent Difference	Smallest Reduction	Percent Difference	Largest Reduction	Smallest Reduction
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(TAF)
Critical	-5	-27%	-1	-2%	-18	-2
Dry and Below Normal	-5	-27%	-1	-2%	-21	-2

Overall, median water surface elevation and median reservoir storage in Little Grass Valley and Sly Creek Reservoirs under the Flexible Purchase Alternative would be decreased from November to April as compared to the Baseline Condition. Water temperatures during these months of the year would be at their lowest points during the annual cycle, and therefore the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into these reservoirs, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, any differences in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect long-term water quality in such a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality in Little Grass Valley and Sly Creek Reservoirs would be less than significant.

New Bullards Bar Reservoir

EWA acquisition of Yuba County Water Agency via stored reservoir water and groundwater substitution would alter surface water elevation and reservoir storage in New Bullards Bar Reservoir, relative to the Baseline Condition.

Table 5-48 provides monthly median reservoir storage and water surface elevation for New Bullards Bar Reservoir. In New Bullards Bar Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage and water surface elevation from the months of July through January as compared to the Baseline Condition. Median reservoir storage would increase by up to 5 percent between April and June. Additionally, median water surface elevation would increase by up to 5 feet between April and June.

Table 5-48
New Bullards Bar Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative

	Storage				Elevation		
Month	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	544	446	-98	-18	1838	1812	-27
Nov	546	449	-98	-18	1839	1812	-26
Dec	532	442	-90	-17	1835	1810	-25
Jan	593	578	-15	-3	1850	1847	-3
Feb	649	649	0	0	1862	1862	0
Mar	735	735	0	0	1878	1878	0
Apr	774	788	14	2	1884	1886	2
May	879	908	28	3	1899	1902	3
Jun	917	960	43	5	1903	1908	5
Jul	825	820	-5	-1	1892	1891	-1
Aug	713	660	-52	-7	1874	1864	-10
Sep	614	514	-100	-16	1855	1831	-24

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of median water surface elevation and median reservoir storage for the months of July through December as compared to the Baseline Condition. During dry and below normal years, reductions of median water surface elevation and median reservoir storage in would occur from July through January compared to the Baseline Condition. The largest reductions would occur during September and the smallest during July under critical and dry and below normal years, relative to the Baseline Condition. Table 5-49 summarizes reductions in water surface elevation and reservoir storage in New Bullards Bar Reservoir in critical and dry and below normal years, compared to the Baseline Condition.

Table 5-49
New Bullards Bar Reservoir End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years

	Water Surface Elevation Reductions				***Reservoir Storage Reductions***	
	Largest Reduction	***Percent Difference***	***Smallest Reduction***	***Percent Difference***	***Largest Reduction***	***Smallest Reduction***
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(TAF)
Critical	-100	-19%	-5	-0.8	-28	-1
Dry and Below Normal	-100	-17%	-5	-0.6%	-25	-1

Overall, median water surface elevation and median reservoir storage at New Bullards Bar Reservoir under the Flexible Purchase Alternative would be decreased from July to January, but would increase from April through June as compared to the Baseline Condition. Water temperatures during the months of greatest reductions (September through December) would be low enough that the decrease in median reservoir storage and water surface elevation would not cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into this reservoir, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, any differences in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be less than significant.

French Meadows and Hell Hole Reservoirs

EWA acquisition of Placer County Water Agency-stored reservoir water would decrease surface water elevation and reservoir storage in French Meadows and Hell Hole reservoirs, relative to the Baseline Condition.

Table 5-50 provides monthly median reservoir storage and water surface elevation for French Meadows Reservoir. In French Meadows Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage and median water surface elevation from the months of July through January as compared to the Baseline Condition.

Table 5-50
French Meadows Reservoir Monthly Median Storage, Elevation and Flow Below Ralston Afterbay Under the Baseline Condition and Flexible Purchase Alternative

	Storage				Elevation			Median Flow Below Ralston (1974-2001)			
Month	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)	Base Cond. (cfs)	FPA (cfs)	Diff (cfs)	Diff (%)
Oct	67	59	-8	-12	5205	5197	-8	258	258	0	0
Nov	59	57	-3	-5	5197	5194	-3	488	275	-213	-43.6
Dec	56	53	-3	-5	5193	5189	-3	265	265	0	0
Jan	61	58	-2	-4	5198	5196	-3	281	266	-15	-5.3
Feb	61	61	0	0	5199	5199	0	437	325	-112	-25.6
Mar	75	75	0	0	5213	5213	0	615	615	0	0
Apr	93	93	0	0	5229	5229	0	554	554	0	0
May	116	116	0	0	5246	5246	0	656	656	0	0
Jun	129	129	0	0	5256	5256	0	631	698	67	10.7
Jul	113	111	-3	-2	5244	5242	-2	629	736	107	17.1
Aug	100	94	-5	-5	5234	5230	-4	666	773	107	16.1
Sep	82	74	-8	-9	5219	5212	-7	456	500	44	9.6

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table 5-51 summarizes monthly median reservoir storage and water surface elevation for French Meadows Reservoir during critical and dry and below normal years. In French Meadows Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical and dry and below normal years would result in reduction of median reservoir storage during the months of July through October as compared to the Baseline Condition.

Table 5-51
French Meadows Reservoir End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years

	Water Surface Elevation Reductions				Reservoir Storage Reductions	
	Largest Reduction	Percent Difference	Smallest Reduction	Percent Difference	Largest Reduction	Smallest Reduction
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(TAF)
Critical	-8	-19%	-2	-4%	-11	-2
Dry and Below Normal	-8	-12%	-3	-3%	-8	-2

In Hell Hole Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage from the months of June through January as compared to the Baseline Condition (Table 5-52).

Table 5-52 Hell Hole Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative							
	Storage				Elevation		
Month	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)
Oct	120	108	-12	-10	4555	4540	-15
Nov	110	106	-4	-4	4542	4536	-6
Dec	104	100	-4	-4	4534	4528	-6
Jan	102	98	-4	-4	4531	4525	-5
Feb	104	104	0	0	4533	4533	0
Mar	110	110	0	0	4542	4542	0
Apr	140	140	0	0	4578	4578	0
May	173	173	0	0	4616	4616	0
Jun	191	187	-4	-2	4637	4632	-5
Jul	168	160	-8	-5	4610	4601	-9
Aug	136	124	-12	-9	4573	4559	-14
Sep	121	109	-12	-10	4555	4540	-15

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table 5-53 summarizes monthly median reservoir storage and water surface elevation for Hell Hole Reservoir during critical and dry and below normal years. In Hell Hole Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical and dry and below normal years would result in reduction of median reservoir storage during the months of June through October as compared to the Baseline Condition. The largest decreases in monthly median reservoir storage and water surface elevation would occur during September in both critical and dry and below normal years compared to the Baseline Condition.

Table 5-53 Hell Hole Reservoir End-of-Month Surface Elevation and Storage for Critical, Dry and Below Normal Years						
	Water Surface Elevation Reductions				Reservoir Storage Reductions	
	Largest Reduction	Percent Difference	Smallest Reduction	Percent Difference	Largest Reduction	Smallest Reduction
Year-type	(FT)	(%)	(FT)	(%)	(TAF)	(TAF)
Critical	-12	-3%	-2	-2%	-18	-3
Dry and Below Normal	-12	-11%	-4	-2%	-16	-4

Overall, median water surface elevation and median reservoir storage under the Flexible Purchase Alternative would decrease from June to January in Hell Hole Reservoir and from July to January in French Meadows Reservoir as compared to the Baseline Condition. Water temperatures during the months of greatest reduction (September and October) would be low enough, given the percentage reduction in median reservoir storage, that the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into these reservoirs, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, any differences in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality in Hell Hole and French Meadows Reservoirs would be less than significant.

<u>Lake McClure</u>

EWA acquisition of Merced Irrigation District (Merced ID) water via groundwater substitution would increase surface water elevation or reservoir storage in Lake McClure, relative to the Baseline Condition.

Table 5-54 provides monthly median reservoir storage and water surface elevation for Lake McClure. In Lake McClure, hydrologic conditions under the Flexible Purchase Alternative would result in an increase in median reservoir storage from the months of May through October as compared to the Baseline Condition. No decreases in median reservoir storage or median water surface elevation would be expected in any month.

Table 5-54
Lake McClure Monthly Median Storage and Elevation
Under the Baseline Condition and Flexible Purchase Alternative

	Storage				***Elevation***		
Month	***Baseline Condition (TAF)***	***FPA (TAF)***	***Diff (TAF)***	***Diff (%)***	***Baseline Condition (ft msl)***	***FPA (ft msl)***	***Diff (ft msl)***
Oct	598	611	13	2	778	779	2
Nov	590	590	0	0	777	777	0
Dec	581	581	0	0	776	776	0
Jan	584	584	0	0	776	776	0
Feb	627	627	0	0	781	781	0
Mar	656	656	0	0	784	784	0
Apr	683	687	3	0	787	787	0
May	774	781	8	1	793	794	0
Jun	865	877	13	1	798	799	1
Jul	774	792	18	2	793	794	1
Aug	682	703	22	3	787	788	2
Sep	615	640	25	4	780	783	3

Based on median monthly storage and flow over the historical record from 1970 to 2001.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

In Lake McClure, hydrologic conditions under the Flexible Purchase Alternative during critical and dry and below normal years would not decrease median water surface elevation and median reservoir storage during any month as compared to the Baseline Condition. Increases would occur from April through October compared to the Baseline Condition.

Overall, median water surface elevation and median reservoir storage under the Flexible Purchase Alternative would be increased from May to October and would remain essentially equivalent from June through September as compared to the Baseline Condition. Increases in median reservoir storage and median water surface elevation would benefit the water quality by providing additional water for dilution of constituents and by providing additional water to buffer water temperature increases. As a result, increases in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be less than significant.

5.2.5.1.3 *Rivers Within the Upstream from the Delta Region*

<u>Sacramento River</u>

EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution, and crop idling under the Flexible Purchase Alternative would not substantially decrease Sacramento River flow, relative to the Baseline Condition.

The long-term average flow in the Sacramento River below Keswick Dam would decrease by less than 0.8 percent under the Flexible Purchase Alternative, compared to the Baseline Condition, during all months of the year as shown in Table 5-55. In fact, long-term average Sacramento River flow below Keswick Dam under the Flexible Purchase Alternative would not decrease in comparison to flows under the Baseline Condition in any month except August and September, when the long-term average decrease in flow would be 0.5 and 0.8 percent, respectively.

Table 5-55
Long-term Average Release From Keswick Dam
Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	5842	5842	0	0.0
Nov	4854	4854	0	0.0
Dec	6672	6672	0	0.0
Jan	7951	7951	0	0.0
Feb	10,056	10,056	0	0.0
Mar	8249	8249	0	0.0
Apr	7706	7706	0	0.0
May	8381	8381	0	0.0
Jun	10,529	10,529	0	0.0
Jul	13,284	13,398	114	0.9
Aug	10,556	10,498	-58	-0.5
Sep	7278	7222	-56	-0.8

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

An evaluation of long-term average flows under the Flexible Purchase Alternative was also done for critical, dry and below normal year hydrologic conditions. Decreases in long-term average flow under the Flexible Purchase Alternative occurred from July through September during a dry year and August through September for critical and below normal years. Table 5-56 summarizes average decreases in long-term average flow in the Sacramento River compared to the Baseline Condition.

Table 5-56
Sacramento River below Keswick Average Decreases in Long-term Average Flow for Critical, Dry and Below Normal Years

Long-term Average Flow Reductions						
	Critical		***Dry***		***Below Normal***	
	(cfs)	(%)	(cfs)	(%)	(cfs)	(%)
July	0	0	-17	0.1%	0	0
August	-170	2%	-42	0.5%	-445	4.4%
September	-187	3.5%	-87	1.7%	-319	4.9%

The long-term average flow in the Sacramento River at Freeport would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table 5-57. In fact, long-term average flows in the Sacramento River at Freeport would increase by more than one percent from April through September under the Flexible Purchase Alternative as compared to the Baseline Condition. Additionally, under the Flexible Purchase Alternative, flow in the Sacramento River at Freeport during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis.

Table 5-57
Long-term Average Sacramento River Flow at Freeport
Under the Baseline Condition and Flexible Purchase Alternative

	Monthly Mean Flow¹ (cfs)		***Difference***	
Month	***Baseline Condition***	***Flexible Purchase Alternative***	***(cfs)***	***(%)²***
Oct	11956	12044	88	0.7
Nov	14769	14783	14	0.1
Dec	24922	24927	5	0.0
Jan	33069	33071	2	0.0
Feb	39225	39226	1	0.0
Mar	34296	34299	3	0.0
Apr	25184	25665	481	1.9
May	19724	20076	352	1.8
Jun	18183	18533	350	1.9
Jul	17777	20919	3142	17.7
Aug	13762	15929	2167	15.7
Sep	13729	14373	644	4.7

¹ Based on 72 years modeled.
² Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, under the Flexible Purchase Alternative, Sacramento River flow at Keswick Dam and Freeport would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in Sacramento River flow at Freeport during summer months would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow under the Flexible Purchase Alternative would not be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution, and crop idling under the Flexible Purchase Alternative would not substantially increase Sacramento River water temperature, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, long-term average water temperature in the Sacramento River at Bend Bridge would not differ during any month of the year, relative to the Baseline Condition (Table 5-58). Moreover, under the Flexible Purchase Alternative, water temperatures in the Sacramento River at Bend Bridge would be essentially equivalent to or less than water temperatures under the Baseline Condition in 826 out of 828 months included in the analysis. Water temperature increases in 2 of 828 months modeled at Bend Bridge would range from 0.1 to 0.5°F [Appendix H, p. 469-480].

Table 5-58
Long-term Average Water Temperature in the Sacramento River at Bend Bridge Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	Flexible Purchase Alternative	Difference (ºF)
Oct	53.6	53.6	0.0
Nov	51.0	51.0	0.0
Dec	47.0	47.0	0.0
Jan	44.9	44.9	0.0
Feb	48.3	48.3	0.0
Mar	52.1	52.1	0.0
Apr	54.5	54.5	0.0
May	54.6	54.6	0.0
Jun	54.6	54.6	0.0
Jul	54.6	54.6	0.0
Aug	56.8	56.8	0.0
Sep	55.8	55.8	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average water temperature in the Sacramento River at Bend Bridge during critical years would be essentially equivalent to or less than the Baseline Condition for 132 months of the 132 months included in the analysis. Under the Flexible Purchase Alternative, the long-term average water temperature in the Sacramento River at Bend Bridge during dry years would be essentially equivalent to or less than the Baseline Condition for 192 months of the 192 months included in the analysis. Under the Flexible Purchase Alternative, the long-term average water temperature in the Sacramento River at Bend Bridge during below normal years would be essentially equivalent to or less than the Baseline Condition for 166 months of the 168 months included in the analysis [Appendix H, p. 1008].

Under the Flexible Purchase Alternative, long-term average water temperature in the Sacramento River at Freeport would not differ from long-term average water temperatures under the Baseline Condition by more than 0.1°F during any month. Additionally, under the Flexible Purchase Alternative, water temperature in the Sacramento River at Freeport during critical, dry, and below normal years would be essentially equivalent to or less than the Baseline Condition for all months included in the analysis.

Overall, water temperature in the Sacramento River at Bend Bridge and Freeport under the Flexible Purchase Alternative would be essentially equivalent to or less than water temperatures relative to the Baseline Condition. Any differences in water temperature would not be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

<u>Lower Feather River</u>
EWA acquisition of Feather River contractor water via groundwater substitution and crop idling under the Flexible Purchase Alternative would not substantially decrease Feather River flow, relative to the Baseline Condition.

The long-term average flow in the Feather River below the Thermalito Afterbay would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table 5-59. In fact, long-term average flows in the lower Feather River below the Thermalito Afterbay would increase by more than one percent from April through October under the Flexible Purchase Alternative as compared to the Baseline Condition.

Table 5-59
Long-term Average lower Feather River Flow Below Thermalito Afterbay Under the Baseline Condition and Flexible Purchase Alternative

	Monthly Mean Flow[1] (cfs)		Difference	
Month	**Baseline Condition**	**FPA**	**(cfs)**	**(%)[2]**
Oct	2441	2509	68	2.8
Nov	2301	2315	14	0.6
Dec	3984	3989	5	0.1
Jan	5005	5007	2	0.0
Feb	5930	5931	1	0.0
Mar	6144	6146	2	0.0
Apr	3416	3734	318	9.3
May	3826	3969	143	3.7
Jun	5084	5192	108	2.1
Jul	5896	7210	1314	22.3
Aug	4434	5737	1303	29.4
Sep	1600	1977	377	23.6

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Decreases in long-term average flow would occur more often during critical, dry, and below normal hydrologic conditions under the Flexible Purchase Alternative. The long-term average flow decrease during critical years would average 1 cfs or less for all months, representing a 0.1 percent or less decrease, compared to the Baseline Condition [Appendix H, p. 1019]. The long-term average flow decrease during dry years would average 163 cfs (2 percent decrease) in July and 3 cfs or less (0.2 percent or smaller decrease) for all other months compared to the Baseline Condition [Appendix H, p. 1019]. The long-term average flow decrease for below normal years would average 252 cfs (3 percent decrease) in July and 4 cfs or less (0.1 percent or less decrease) for all other months, compared to the Baseline Condition [Appendix H, p. 1019].

The long-term average flow at the mouth of the Feather River would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year, as shown in Table 5-60. Additionally, under the Flexible Purchase Alternative, flow at the mouth of the Feather River during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis.

Table 5-60
Long-term Average Feather River Flow at the Mouth
Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	FPA	(cfs)	(%)[2]
Oct	3284	3352	68	2.1
Nov	3482	3496	14	0.4
Dec	6227	6232	5	0.1
Jan	11355	11357	2	0.0
Feb	13096	13097	1	0.0
Mar	13182	13184	2	0.0
Apr	9518	9836	318	3.3
May	7735	7877	142	1.8
Jun	7647	7755	108	1.4
Jul	6311	8497	2186	34.6
Aug	4881	6512	1631	33.4
Sep	3404	3852	448	13.2

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, under the Flexible Purchase Alternative, Feather River flow below the Thermalito Afterbay and at the mouth would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in Feather River flow below Thermalito Afterbay and at the mouth during summer months would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow would not be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

EWA acquisition of Feather River contractor water via stored reservoir water, groundwater substitution, and crop idling under the Flexible Purchase Alternative would not substantially increase Feather River water temperature, relative to the Baseline Condition. Under the Flexible Purchase Alternative, long-term average water temperature in the Feather River at the Fish Barrier Dam would not differ during any month of the year, relative to the Baseline Condition (Table 5-61).

Table 5-61
Long-term Average Water Temperature in the Feather River Below the Fish Barrier Dam Under the Baseline Condition and Flexible Purchase Alternative

	Water Temperature[1] (ºF)		
Month	**Baseline Condition**	**FPA**	**Difference (ºF)**
Oct	54.0	54.0	0.0
Nov	52.4	52.4	0.0
Dec	48.0	48.0	0.0
Jan	46.0	46.0	0.0
Feb	47.1	47.1	0.0
Mar	49.0	49.0	0.0
Apr	51.0	51.0	0.0
May	55.3	55.3	0.0
Jun	57.4	57.4	0.0
Jul	61.6	61.6	0.0
Aug	60.8	60.8	0.0
Sep	56.5	56.5	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, long-term average water temperature in the Feather River below Thermalito Afterbay would not differ from long-term average temperatures under the Baseline Condition during any month of the year. Additionally, under the Flexible Purchase Alternative, water temperature below the Thermalito Afterbay in the Feather River during critical, dry, and below normal years would be essentially equivalent to or less than the Baseline Condition for all months included in the analysis.

Under the Flexible Purchase Alternative, long-term average water temperature at the mouth of the Feather River would not increase from the long-term average water temperature under the Baseline Condition by more than 0.2°F during any month, as shown in Table 5-62.

Table 5-62 Long-term Average Water Temperature at the Mouth of the Feather River Under the Baseline Condition and Flexible Purchase Alternative			
	Water Temperature[1] (ºF)		
Month	Baseline Condition	FPA	Difference (ºF)
Oct	61.3	61.3	0.0
Nov	52.4	52.4	0.0
Dec	45.9	45.9	0.0
Jan	45.3	45.3	0.0
Feb	49.6	49.6	0.0
Mar	54.2	54.2	0.0
Apr	59.8	59.9	0.1
May	65.5	65.6	0.1
Jun	70.0	70.2	0.2
Jul	73.6	73.6	0.0
Aug	72.2	71.8	-0.4
Sep	69.7	69.2	-0.5

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Increases in long-term average temperatures at the mouth of the Feather River also would occur in critical, dry and below normal hydrologic conditions, under the Flexible Purchase Alternative. The greatest long-term average water temperature increase (0.35ºF or 0.5 percent) during critical years would occur in May compared to the Baseline Condition [Appendix H, p. 1018]. The greatest long-term average water temperature increase (0.33ºF or 0.5 percent) during dry years also would occur during May, compared to the Baseline Condition [Appendix H, p. 1018]. The greatest long-term average water temperature increase (0.24ºF or 0.3 percent) during below normal years would occur during June, compared to the Baseline Condition [Appendix H, p. 1018].

Overall, water temperature in the Feather River below the Thermalito Afterbay, and at the mouth under the Flexible Purchase Alternative would infrequently be increased by up to 0.7°F and would otherwise be essentially equivalent to or less than water temperatures relative to the Baseline Condition. Any differences in water temperature would not be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

<u>Lower Yuba River</u>
EWA acquisition of lower Yuba River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter lower Yuba River flow, relative to the Baseline Condition.

The Yuba River is one of many Central Valley rivers that have been utilized in water transfer projects for a number of years. In 2001, Yuba County Water Agency (YCWA) and other local water agencies initiated water transfers from New Bullards Bar Reservoir through the Yuba River in order to satisfy a variety of downstream needs. The total water transfer consisted of approximately 172,000 acre-feet of water, including 114,052 acre-feet utilized by DWR. The water transfers occurred approximately between July 1, 2001 and October 14, 2001. The water transfers increased flows by about 1,200 cfs in the lower Yuba River through late August. Yuba River water transfers also occurred during 2002. Yuba County Water Agency transferred a total of 162,050 acre-feet of water for downstream needs (157,050 acre-feet allocated to DWR, and 5,000 acre-feet to the Contra Costa WD) from approximately mid-June through September, 2002.

Recent historic flows in the Yuba River below Englebright Dam during June through October, the typical time period for water transfers, have been between approximately 600 and 2,500 cfs. Preliminary hydrologic modeling output for flows under the Baseline Condition (without EWA transfer) below Englebright Reservoir would range between approximately 1,000 and 1,800 cfs during June, July, and most of August, ramp down in late August and early September to 500 cfs to 900 cfs, and remain relatively constant at 600 to 900 cfs for October and November until the wet season, at which time unregulated winter storm and snowmelt flows affect the lower Yuba River hydrology. Below Daguerre Point Dam, baseline flows could range from approximately 245 to 800 cfs in June, and from 100 to 250 cfs during July, August, and September. Flows below Daguerre Point Dam in the first two weeks in October could be about 320 to 400 cfs and increase to 400 to 500 cfs for the last two weeks of October through the time period in the winter when runoff from winter storms significantly affect river flows.

Under the Flexible Purchase Alternative, the proposed transfer of 185,000 acre-feet to the EWA is expected to take place mainly in July and August, with some water potentially released between June 1 and July 31, and between September 1 and October 31. During late June, July, and August, flow rates would be relatively constant, at up to 1,200 to 1,500 cfs above Yuba River instream flow and diversion delivery requirements.

Overall, under the Flexible Purchase Alternative, lower Yuba River flow would be greater than the flows under the Baseline Condition, based on data from previous water transfers. Increases in lower Yuba River flow would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, increases in flow would not be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

EWA acquisition of lower Yuba River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter lower Yuba River water temperature, relative to the Baseline Condition.

Monitoring of lower Yuba River water temperatures during past water transfers showed that water temperatures at the mouth of the Yuba River (Highway 70 Bridge) were approximately 73ºF prior to the 2001 water transfers. At the same time, similar water temperatures were observed on the Feather River, one kilometer above its confluence with the Yuba River. After the initiation of the 2001 water transfers, water temperatures at the mouth of the Yuba River dropped to an average of 61ºF for the remainder of the month (CDFG, unpublished data). Water temperatures at this site remained around 61ºF until flows were reduced in late August, at which time the water temperatures increased coincident with flow reduction. Although an evaluation of the numerous variables (e.g., ambient air temperature, cloud cover, diversion rates) which may influence instream water temperatures has not yet been conducted, changes in Yuba River water temperatures were observed coincident with the water transfers.

Overall, under the Flexible Purchase Alternative, lower Yuba River water temperatures would be less than the water temperatures under the Baseline Condition, based on data from previous water transfers. Decreases in Yuba River water temperature with implementation of the Flexible Purchase Alternative would not be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

Middle Fork American River

EWA acquisition of American River contractor water via stored reservoir water and crop idling under the Flexible Purchase Alternative would alter Middle Fork American River flow, relative to the Baseline Condition.

The median flow in the Middle Fork American River below Ralston Afterbay would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during nine months of the year as shown in Table 5-50. However, median flow in the Middle Fork American River would decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during November, January and February. Median flow in the Middle Fork American River would decrease by 43.6 percent in November, 5.3 percent in January, and 25.6 percent in February.

Table 5-63 summarizes the largest increases and reductions in median flow in the Middle Fork American River below Ralston Afterbay during critical, dry, and below normal years under the Flexible Purchase Alternative, compared to the Baseline Condition. Decreases in flow generally occur during October or November in critical and dry and below normal years relative to the Baseline Condition.

Table 5-63
Median Flows in Middle Fork American River below Ralston Afterbay for Critical, Dry and Below Normal Years

	Changes in Median Flows			
	Largest Increase	Percent Difference	Largest Decrease	Percent Difference
Year-type	(cfs)	(%)	(cfs)	(%)
Critical	107	27.5%	-265	-81.9%
Dry and Below Normal	107	21.3%	333	-60.4%

Overall, under the Flexible Purchase Alternative, Middle Fork American River median flow below Ralston Afterbay would be essentially equivalent to greater than flows under the Baseline Condition in nine months out of the year. Median flow in the Middle Fork American River would decrease in November, January, and February under the Flexible Purchase Alternative as compared to the Baseline Condition. Increases in Middle Fork American River flow below Ralston Afterbay in June, July, August, and September would allow dilution of water quality constituents. Decreased flows during the months of greatest flow reduction (November and February) would not be expected to cause an increase in water quality constituents that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality because the water quality in the Middle Fork American River is of high quality and concentrations of constituents are generally low. Consequently, potential flow-related effects to water quality would be less than significant.

<u>Lower American River</u>
EWA acquisition of stored groundwater from Sacramento Groundwater Authority members, stored reservoir water, and water obtained through Placer Country Water Agency crop idling and retained in Folsom Reservoir under the Flexible Purchase Alternative would increase lower American River flow, relative to the Baseline Condition.

The long-term average flow in the lower American River below Nimbus Dam, at Watt Avenue, and at the mouth of the American River would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during all months of the year as shown in Table 5-64, Table 5-65, and Table 5-66 respectively. Additionally, under the Flexible Purchase Alternative, flow in the lower American River below Nimbus Dam, at Watt Avenue, and at the mouth of the American River during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis [Appendix H, p. 1015].

Table 5-64
Long-term Average Release to the Lower American River From Nimbus Dam Under the Baseline Condition and Flexible Purchase Alternative

	Monthly Mean Flow[1] (cfs)		Difference	
Month	**Baseline Condition**	**Flexible Purchase Alternative**	**(cfs)**	**(%)[2]**
Oct	1678	1678	0	0.0
Nov	2502	2502	0	0.0
Dec	3498	3498	0	0.0
Jan	4124	4124	0	0.0
Feb	4989	4989	0	0.0
Mar	3941	3941	0	0.0
Apr	3616	3616	0	0.0
May	3793	3793	0	0.0
Jun	4166	4166	0	0.0
Jul	4100	4208	108	2.6
Aug	2482	2528	46	1.9
Sep	2876	2885	9	2.6

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table 5-65 **Long-term Average Flow at Watt Avenue** **Under the Baseline Condition and Flexible Purchase Alternative**				
	Monthly Mean Flow[1] (cfs)		**Difference**	
Month	**Baseline Condition**	**Flexible Purchase Alternative**	**(cfs)**	**(%)[2]**
Oct	1507	1507	0	0.0
Nov	2385	2385	0	0.0
Dec	3402	3402	0	0.0
Jan	4038	4038	0	0.0
Feb	4906	4906	0	0.0
Mar	3861	3861	0	0.0
Apr	3428	3428	0	0.0
May	3531	3531	0	0.0
Jun	3814	3814	0	0.0
Jul	3729	3837	108	2.9
Aug	2148	2194	46	2.1
Sep	2633	2642	9	0.3

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table 5-66 **Long-term Average Flow at the Mouth of the lower American River** **Under the Baseline Condition and Flexible Purchase Alternative**				
	Monthly Mean Flow[1] (cfs)		**Difference**	
Month	**Baseline Condition**	**Flexible Purchase Alternative**	**(cfs)**	**(%)[2]**
Oct	1557	1557	0	0.0
Nov	2426	2426	0	0.0
Dec	3441	3441	0	0.0
Jan	4077	4077	0	0.0
Feb	4949	4949	0	0.0
Mar	3902	3902	0	0.0
Apr	3518	3518	0	0.0
May	3632	3632	0	0.0
Jun	3936	3936	0	0.0
Jul	3851	3958	107	2.8
Aug	2253	2299	46	2.0
Sep	2707	2716	9	0.3

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1, Assessment Methods.

Overall, under the Flexible Purchase Alternative, lower American River flow below Nimbus Dam, at Watt Avenue, and at the mouth would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in lower American River flow at all three locations during July and August and during September at Nimbus Dam would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow would not be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

EWA acquisition of stored groundwater from Sacramento Groundwater Authority members, stored reservoir water, and water obtained through Placer Country Water Agency crop idling and retained in Folsom Reservoir under the Flexible Purchase Alternative would not substantially increase American River water temperature, relative to the Baseline Condition. Under the Flexible Purchase Alternative, long-term average water temperature in the American River below Nimbus Dam would slightly increase during several months, relative to the Baseline Condition (Table 5-67).

Table 5-67
Long-term Average Water Temperature in the American River Below Nimbus Dam Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	Flexible Purchase Alternative	Difference (ºF)
Oct	56.3	56.3	0.0
Nov	56.5	56.5	0.0
Dec	51.2	51.2	0.0
Jan	47.2	47.1	-0.1
Feb	47.8	47.8	0.0
Mar	50.3	50.4	0.1
Apr	53.7	53.8	0.1
May	56.5	56.6	0.1
Jun	59.6	59.6	0.0
Jul	64.3	64.3	0.0
Aug	64.5	64.6	0.1
Sep	65.9	66.1	0.2

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1, Assessment Methods.

Evaluation of long-term average water temperature in the American River below Nimbus Dam under the Flexible Purchase Alternative was also done for critical, dry, and below normal hydrologic conditions. Table 5-68 summarizes the largest increases in long-term average water temperature during each hydrologic condition.

Table 5-68
Long-term Average Temperature Increases in the Lower American River below Nimbus Dam for Critical, Dry and Below Normal Years

Year-type	Changes in Average Temperature		
	Largest Increase	Percent Difference	Month Largest Increase Occurs
Critical	0.36ºF	0.5%	September
Dry	0.27ºF	0.5%	September
Below Normal	0.25ºF	0.4%	October

Under the Flexible Purchase Alternative, long-term average water temperature in the American River at Watt Avenue would not differ from long-term average water temperatures under the Baseline Condition by more than 0.1°F during any month, as shown in Table 5-69.

Table 5-69
Long-term Average Water Temperature in the American River at Watt Avenue Under the Baseline Condition and Flexible Purchase Alternative

	Water Temperature[1] (ºF)		
Month	**Baseline Condition**	**Flexible Purchase Alternative**	**Difference (ºF)**
Oct	57.7	57.7	0.0
Nov	55.8	55.8	0.0
Dec	50.2	50.2	0.0
Jan	46.7	46.7	0.0
Feb	48.2	48.2	0.0
Mar	51.2	51.3	0.1
Apr	55.1	55.2	0.1
May	58.7	58.7	0.0
Jun	62.0	62.0	0.0
Jul	66.2	66.2	0.0
Aug	66.9	66.9	0.0
Sep	66.8	66.8	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Evaluation of long-term average water temperature in the American River at Watt Avenue under the Flexible Purchase Alternative was also done for critical, dry, and below normal hydrologic conditions. Table 5-70 summarizes the largest increases in long-term average water temperature during each hydrologic condition.

Table 5-70
Long-term Average Temperature Increases in the Lower American River at Watt Avenue for Critical, Dry and Below Normal Years

	Changes in Average Temperature		
Year-type	**Largest Increase**	**Percent Difference**	**Month(s) Largest Increase Occurs**
Critical	0.33ºF	0.5%	September
Dry	0.20ºF	0.3%	July, August, September
Below Normal	0.23ºF	0.4%	November

Under the Flexible Purchase Alternative, long-term average water temperature at the mouth of the American River would slightly differ from long-term average temperatures under the Baseline Condition during any month, as shown in Table 5-71.

Table 5-71 **Long-term Average Water Temperature at the Mouth of the American River Under the Baseline Condition and Flexible Purchase Alternative**			
	Water Temperature[1] (ºF)		
Month	**Baseline Condition**	**Flexible Purchase Alternative**	**Difference (ºF)**
Oct	58.4	58.4	0.0
Nov	55.5	55.5	0.0
Dec	49.7	49.6	-0.1
Jan	46.5	46.5	0.0
Feb	48.5	48.5	0.0
Mar	51.7	51.8	0.1
Apr	55.8	55.9	0.1
May	59.7	59.8	0.1
Jun	63.2	63.3	0.1
Jul	67.2	67.2	0.0
Aug	68.1	68.1	0.0
Sep	67.3	67.3	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Evaluation of long-term average water temperature at the mouth of the American River under the Flexible Purchase Alternative was also done for critical, dry, and below normal hydrologic conditions. Table 5-72 summarizes the largest increases in long-term average water temperature during each hydrologic condition.

Table 5-72 **Long-term Average Temperature Increases Lower American River Mouth for Critical, Dry and Below Normal Years**			
	Changes in Average Temperature		
Year-type	**Largest Increase**	**Percent Difference**	**Month(s) Largest Increase Occurs**
Critical	0.45ºF	0.7%	September
Dry	0.20ºF	0.3%	July
Below Normal	0.25ºF	0.5%	November

Overall, water temperature in the American River below Nimbus Dam, at Watt Avenue and at the mouth under the Flexible Purchase Alternative would slightly increase or would otherwise be essentially equivalent to or less than water temperatures relative to the Baseline Condition. Any differences in water temperature would not be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

Merced River

EWA acquisition of Merced River contractor water via groundwater substitution under the Flexible Purchase Alternative would increase Merced River flow, relative to the Baseline Condition.

The long-term average flow in the Merced River below Crocker-Huffman Dam and at the mouth of the Merced River would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during any month of the year as shown in Table 5-73 and Table 5-74, respectively.

Table 5-73
Long-term Average Flow Below Crocker-Huffman Dam
Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	812	1015	203	25.0
Nov	231	441	210	90.9
Dec	353	353	0	0.0
Jan	493	493	0	0.0
Feb	784	784	0	0.0
Mar	500	500	0	0.0
Apr	501	501	0	0.0
May	894	894	0	0.0
Jun	881	881	0	0.0
Jul	329	329	0	0.0
Aug	159	159	0	0.0
Sep	178	178	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table 5-74
Long-term Average Flow at the Mouth of the Merced River
Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	881	1085	204	23.2
Nov	288	499	211	73.3
Dec	438	438	0	0.0
Jan	596	596	0	0.0
Feb	936	936	0	0.0
Mar	654	654	0	0.0
Apr	517	517	0	0.0
May	865	865	0	0.0
Jun	827	827	0	0.0
Jul	333	333	0	0.0
Aug	189	189	0	0.0
Sep	193	193	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, under the Flexible Purchase Alternative, Merced River flow below Crocker-Huffman Dam and at the mouth would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in Merced River flow at Crocker-Huffman Dam and at the mouth during October and November would allow dilution of water quality constituents. As a result, any differences in flow would not be of sufficient frequency and magnitude to affect water quality in such a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

San Joaquin River

EWA acquisition of Merced River contractor water via groundwater substitution under the Flexible Purchase Alternative would increase San Joaquin River flow, relative to the Baseline Condition.

The long-term average flow in the San Joaquin River below the confluence with the Merced River would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during any month of the year as shown in Table 5-75.

Table 5-75
Long-term Average San Joaquin River Flow Below the Merced River Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	1391	1594	203	14.6
Nov	729	939	210	28.8
Dec	1138	1138	0	0.0
Jan	1648	1648	0	0.0
Feb	2381	2381	0	0.0
Mar	2066	2066	0	0.0
Apr	1739	1739	0	0.0
May	2236	2236	0	0.0
Jun	1997	1997	0	0.0
Jul	830	830	0	0.0
Aug	575	575	0	0.0
Sep	774	774	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

The long-term average flow at Vernalis in the San Joaquin River (for this analysis, also referred to as the long-term average Delta inflow from the San Joaquin River) would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table 5-76.

Table 5-76 Long-term Average Delta Inflow from the San Joaquin River Under the Baseline Condition and Flexible Purchase Alternative				
	Monthly Mean Flow[1] (cfs)		Difference	
Month	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	3016	3219	203	6.7
Nov	1980	2190	210	10.6
Dec	3038	3038	0	0.0
Jan	4505	4505	0	0.0
Feb	6392	6392	0	0.0
Mar	6361	6361	0	0.0
Apr	6127	6127	0	0.0
May	5482	5482	0	0.0
Jun	4219	4219	0	0.0
Jul	2314	2314	0	0.0
Aug	1696	1696	0	0.0
Sep	1909	1909	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, under the Flexible Purchase Alternative, San Joaquin River flow below the confluence with the Merced River and at Vernalis would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in San Joaquin River flow at both locations during October and November would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow would not be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

5.2.5.1.4 Sacramento-San Joaquin Delta Region

EWA acquisition of water under the Flexible Purchase Alternative would alter the timing of CVP/SWP exports from the Delta, relative to the Baseline Condition.

As discussed in Section 5.2.1.1.3, EWA agencies would implement actions to protect fish in the winter and spring months. The water supply lost due to pumping reductions during these months would be repaid in whole or in part during the summer by water acquired upstream from the Delta and pumped through the Delta to the CVP/SWP water users. Acquired water would reach the Delta during July through September and the CVP and/or SWP pumping plants would pump this water during that period.

The EWA actions implemented in the winter and spring months are reductions in export pumping at the CVP and SWP pumping plants. The reductions in export pumping almost always result in an increase in Delta outflow which in turn results in improvement of in-Delta water quality. The increase in CVP and SWP export pumping during the July through September months to assist in paying back the CVP and SWP for water lost due to the export pumping reductions has the potential to degrade in-Delta water quality. Any increase in chloride concentrations in the Delta would have some potentially adverse effects on in-Delta water users and water users south of the Delta. One of the primary objectives of CALFED is to improve the water quality received by urban water users from the Delta. Any degradation of in-Delta water quality, especially the water received by urban users of Delta water, would be contrary to EWA and CALFED objectives and would be an adverse effect.

As described in Section 5.2.2, EWA agencies would use carriage water to protect and maintain chloride concentrations in the Delta. Therefore, water quality within the Delta would remain essentially unchanged during increased pumping periods under the Flexible Purchase Alternative as compared to the Baseline Condition. As a result the quality of water supplied to in-Delta water users, including Contra Costa WD and others, would be expected to remain essentially equivalent to the Baseline Condition.

The use of carriage water as a mechanism to increase Delta outflows would not only result in no increase in chloride concentrations within the Delta during increased pumping, but would also result in no increase in bromide concentrations within the Delta during increased pumping. The increase in Delta outflow will hold the ocean salts at the same point they were before pumping was increased for the EWA Program. Because bromide is primarily present as a result of seawater intrusion, the use of carriage water to increase Delta outflow and hold ocean salts at the same point they were before pumping was increased would result in no increase in bromide concentrations. As a result, water quality, including salinity, bromide, and the potential for THM and bromate formation, would not be altered in a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality.

With respect to organic carbon, the Sacramento River consistently exhibits lower organic carbon concentrations than the San Joaquin River and other locations in the Delta. Because increases in Delta outflow during months of increased pumping will come from additional inflow from the Sacramento River, which is water of relatively high quality with respect to organic carbon, increased pumping during the summer months would not result in concentrations of carbon in the Delta under the Flexible Purchase Alternative as compared to the Baseline Condition. Therefore, water quality, including total organic carbon and the potential for THM formation associated with organic carbon, would not be altered in a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality.

Consequently, overall potential effects to water quality, including salinity, bromide, organic carbon, THM formation potential, and potential for bromate formation, would be less than significant.

EWA acquisition of water under the Flexible Purchase Alternative would alter the timing of CVP/SWP exports to downstream municipal users, relative to the Baseline Condition.

In years when EWA actions occur in the Delta, the quality of water (specifically, the average annual salt load) delivered to the CVP and SWP could be affected because of the change in the monthly pumping pattern resulting from EWA actions. When pumping is reduced by EWA actions in the winter and spring months to repay in whole or in part the water lost from pumping reductions, the CVP/SWP forego pumping water that has relatively low chloride concentrations. To pay back the CVP/SWP projects for all or a portion of the water lost due to the pumping reductions, DWR and Reclamation would increase project pumping during July through September, when the chloride in the Delta may be higher than the chloride concentrations during winter and spring months. However, it is difficult to generalize about seasonal trends because depending on the specific month in a season, these trends are not consistent. For example, median chloride concentrations in July are lower than median concentrations in December and January, and median chloride concentrations in August are similar to those occurring in January (Figure 5-4). As a result, changes in the monthly pumping pattern under the EWA Program have the potential to result in water of higher chloride concentrations being delivered to the CVP and SWP water users south of the Delta during months of increased pumping, resulting in more total salts being delivered to these water users over an annual period (total annual salt load). Similar patterns and trends exist for bromide. Therefore, changes in the monthly pumping pattern under the EWA Program have the potential to change the bromide concentrations of water being delivered to the CVP/SWP water users south of the Delta during months of increased pumping. This would result in a change of the total salts being delivered to these water users over an annual period (total annual salt load). For this reason, a quantitative analysis of the total annual chloride load and total annual bromide load was conducted to determine whether or not changes in the monthly pumping pattern would result in an increase in the total annual salt load delivered to CVP and SWP water users in south of the Delta.

To assess the effect of changing the pumping patterns associated with EWA actions on the total annual salt load delivered to the CVP and SWP water users, two analyses were conducted that assumed there would be no change in the chloride or bromide concentrations within the Delta under the Flexible Purchase Alternative as compared to the Baseline Condition. This assumption was made because carriage water would be used to ensure no change to chloride or bromide concentrations under the Flexible Purchase Alternative as compared to the Baseline Condition, as described above. The EWA actions (export reductions) assumed to occur in the Delta are described in detail in Attachment 1. Assumed EWA actions are described for the period of 1979 to 1993 as described in Attachment 1, and therefore the chloride and bromide loading was calculated for this 15 year period. The modeling results describing chloride and bromide loading under the Flexible Purchase Alternative are presented below.

Under the Flexible Purchase Alternative, the median monthly chloride loading (in tons) over the 15 year period of record at CVP/SWP export locations (Tracy Pumping

Plant and Banks Pumping Plant) would be less than the median monthly chloride loading under the Baseline Condition from December through June, as illustrated in Figure 5-12. Median monthly chloride loading would decrease by 6.2 percent in December, 5.2 percent in January, 4.3 percent in February, 22.0 percent in March, 44.7 percent in April, 41.2 percent in May, and 15.8 percent in June. Additionally, the median monthly chloride loading (in tons) over the 15 year period of record at CVP/SWP export locations (Tracy Pumping Plant and Banks Pumping Plant) would be the same as the median monthly chloride loading under the Baseline Condition in October and November, as illustrated in Figure 5-12. In July, August and September, the median monthly chloride loading would be greater under Flexible Purchase Alternative than under the Baseline Condition. Median monthly chloride loading would increase by 10.8 percent in July, 20.9 percent in August, and 18.0 percent in September. Overall, the total chloride loading at CVP/SWP export locations over the 15 year period of record would be 7,238,736 tons of chloride under the Baseline Condition, and 7,118,109 tons of chloride under the Flexible Purchase Alternative. Thus, compared to the Baseline Condition, the total chloride loading to CVP/SWP export locations under the Flexible Purchase Alternative over the 15 year period of record represents a 1.7 percent decrease in total chloride loading.

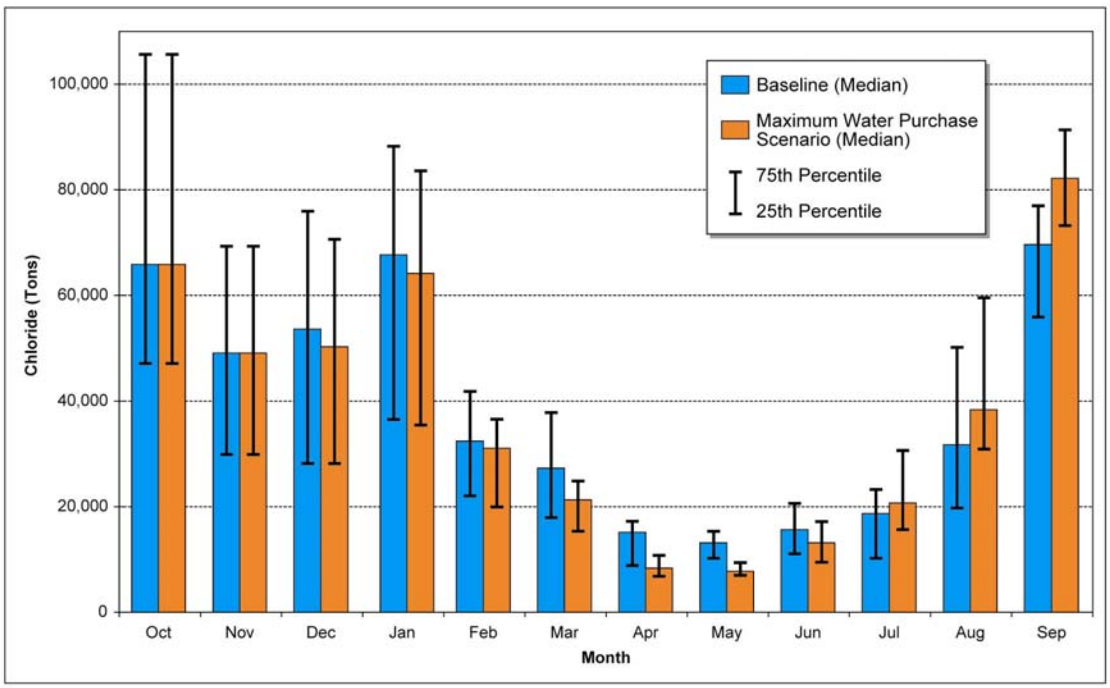

Figure 5-12
Median monthly chloride loading at CVP/SWP except locations (combined Tracy Pumping Plant and Banks Pumping Plant) occurring under the Flexible Purchase Alternative over the 15 year period of record

Note: Bars represent median monthly chloride loading, while error bars represent the 25th-perentile and 75th-percentile monthly chloride loading.

As described in Section 5.1.5.2.1, bromide patterns in the Delta are generally similar to salinity patterns in the Delta. As a result, it is not unexpected that under the Flexible Purchase Alternative, median monthly bromide loading to CVP/SWP export locations exhibit similar trends as median monthly chloride loading. For example, under the Flexible Purchase Alternative, the median monthly bromide loading (in tons) over the 15 year period of record at CVP/SWP export locations (Tracy Pumping Plant and Banks Pumping Plant) would be less than the median monthly bromide loading under the Baseline Condition from December through June, as illustrated in Figure 5-13. Additionally, the median monthly bromide loading (in tons) over the 15 year period of record at CVP/SWP export locations (Tracy Pumping Plant and Banks Pumping Plant) would be the same as the median monthly bromide loading under the Baseline Condition in October and November, as illustrated in Figure 5-13. In July, August and September, the median monthly bromide loading would be greater under the Flexible Purchase Alternative than under the Baseline Condition, as illustrated in Figure 5-13. Overall, the total bromide loading at CVP/SWP export locations over the 15 year period of record would be 24,684 tons of bromide under the Baseline Condition, and 24,273 tons of bromide under the Flexible Purchase Alternative, or a 1.7 percent decrease in total bromide loading.

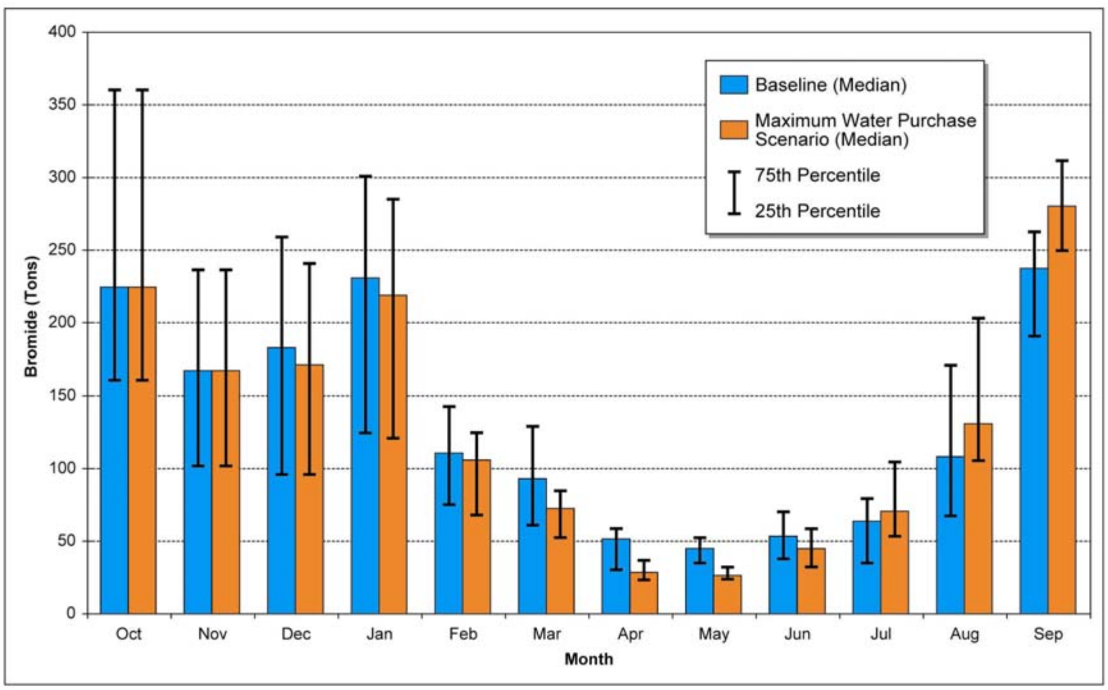

Figure 5-13
Median monthly bromide loading at CVP/SWP export locations (combined Tracy Pumping Plant and Banks Pumping Plant) occurring under the Flexible Purchase Alternative over the 15 year period of record

Note: Bars represent median monthly bromide loading, while error bars represent the 25th-perentile and 75th-percentile monthly bromide loading.

The results of the chloride and bromide modeling illustrate that under Flexible Purchase Alternative, in 9 months of the year, the median monthly chloride and bromide loading at CVP/SWP export locations over the period of record would be less than the median monthly chloride and bromide loading occurring under the Baseline Condition. Additionally, the total chloride and bromide loading at

CVP/SWP export locations over the period of record would be less than the total chloride and bromide loading occurring under the Baseline Condition. The model results illustrate that water quality, including salinity, bromide, and the potential for THM and bromate formation, of the water delivered to the CVP and SWP water users south of the Delta would not being altered in a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality.

With respect to organic carbon, the EWA Program would decrease pumping during winter and spring months, and would increase pumping in summer months, primarily during July, August, and September. By decreasing pumping when carbon concentrations are highest (winter months) and increasing pumping and when carbon concentrations are lowest (summer months), organic carbon concentrations in water supplied to in-Delta water users and CVP and SWP users would, at a minimum, remain equivalent to the carbon concentrations that would have occurred in the absence of the EWA Program. In fact, under the Flexible Purchase Alternative, the increased pumping that would occur during the summer months when organic carbon concentrations are lower may potentially result in a net benefit to water quality with respect to organic carbon concentrations in water supplied to in-Delta water users and CVP and SWP users. Therefore, water quality, including total organic carbon and the potential for THM formation associated with organic carbon, would not be altered in a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality.

In summary, increasing SWP and CVP pumping for the purpose of transporting EWA water acquired in the Upstream from the Delta Region during the summer months would not increase chloride or bromide concentrations in the Delta, because of the utilization of carriage water. Therefore, water quality supplied to downstream users and in-Delta users would be equivalent during periods EWA water is being pumped at the CVP and SWP pumping plants under the Flexible Purchase Alternative and under the Baseline Condition.

Even though carriage water would ensure no Delta water quality degradation during periods of increased pumping of EWA water during the summer, and even though Delta water quality will be improved when the EWA Management Agencies decrease SWP and CVP pumping to protect and restore listed and candidate fish species during the winter and spring months, the total annual salt load pumped at SWP and CVP pumping plants could be increased due to changes in pumping patterns caused by EWA Actions. Modeling results illustrate that EWA Actions do not increase the total salts (total chloride and bromide loading) pumped at the SWP and CVP pumping plants to CVP and SWP water users.

Overall, water quality, including salinity, bromide and organic carbon and the potential for THM and bromate formation, would not be altered in a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, overall potential effects to water quality within the Delta would be less than significant.

5.2.5.2 Crop Idling

5.2.5.2.1 Upstream from the Delta Region

The potential effects to water quality associated with crop idling in Butte, Colusa, Glenn, Placer, Sutter, and Yolo Counties would not differ by county, river, or basin. Therefore, the potential effects to water quality under the Flexible Purchase Alternative as compared to the Baseline Condition are evaluated for all areas upstream from the Delta as a whole.

EWA acquisition of water via crop idling of rice in the Sacramento Valley would result in temporary conversion of lands from rice crops to bare fields.

Crop management practices and soil textures are key factors in determination of erosion potential. Idling would result in an increased number of bare fields, which may result in increased potential for sediment transport via wind erosion. Increased sediment transport via wind erosion could result in increased deposition of transported sediment onto surface waterbodies, thus potentially affecting water quality directly. However, the rice crop cycle and the soil textures in the Sacramento Valley reduce the potential for wind erosion in this region. The process of rice cultivation includes incorporating the leftover rice straw into the soils after harvest through discing, a commonly used practice among farmers. After harvest and discing in late September and October, the fields are flooded to aid in decomposition of the straw. Under the crop idling component of the Flexible Purchase Alternative, no irrigation water would be applied to the fields after farmers flood their fields in the winter, and the soil would be expected to remain moist until approximately mid-May. Once dried, the combination of decomposed straw and clay soils produces a hard, crust-like surface. If left undisturbed, this surface texture would remain intact throughout the summer, when wind erosion would be expected to occur, until winter rains begin. In contrast to sandy topsoil, this surface type would not be conductive to soil loss from wind erosion. During the winter rains, the hard, crust-like surface would remain intact and the amount of sediment transported through winter runoff would not be expected to increase. Therefore, there would be little to no increase in sediment transport resulting from wind erosion or winter runoff from idled fields under the Flexible Purchase Alternative as compared to the Baseline Condition. Because there would be little to no increase in sediment transport under the Flexible Purchase Alternative as compared to the Baseline Condition, there would be little to no increase in the amount of fugitive dust or sediment that could be deposited onto and in surface waterbodies. As a result, there would be little to no decrease in the physiochemical qualities of surface water and adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality would not be expected. The effect to water quality would therefore be less than significant.

EWA acquisition of water via crop idling of rice in the Sacramento Valley would alter the timing and quantity of water applied to the land.

Under the Baseline Condition, farmers would harvest their crop in late September and October. Residue disposal and discing would occur in late October and November. During the winter, farmers would flood the rice fields to aid in decomposition of the rice straw. Fields would be disced the following March and April, planted, and irrigated throughout the summer. Harvest of the rice crop would occur in late September and October, thus completing the rice crop cycle. Under the Flexible Purchase Alternative, farmers would harvest in late September and October, and disc in late October and November for residue disposal purposes. Farmers would flood the rice fields during the winter to aid in decomposition of the rice straw. However, with idling, crop lands would not be planted and irrigated the following summer. The soil would be expected to remain moist until approximately mid-May as a result of the flooding of the fields in the winter. The decomposed straw and clay soil would dry throughout the summer, resulting in a hard, crust-like surface. The soil would not become moist again until the winter rains begin in approximately November.

With respect to the timing and quantity of water applied to the land, the Baseline Condition and conditions under the Flexible Purchase Alternative differ in some regards. Under the Baseline Condition, crops would be harvested in late September and October and the leftover rice straw would be incorporated into the soil through discing following harvest. During the winter rains, beginning in November, fields would be wetted by rainfall. Additionally, under the Baseline Condition, water would be applied to fields in the winter to aid in rice straw decomposition and in the summer for irrigation. Fertilizers and pesticides would be applied in the spring, and the land would be irrigated throughout the summer. Under the Flexible Purchase Alternative, crops would be harvested in late September and October and the leftover rice straw would be incorporated into the soil through discing following harvest. Water would be applied to fields in the winter as in the Baseline Condition. However, water would not be applied during the following summer for irrigation because of crop idling. As in the Baseline Condition, rainfall beginning in November would serve to wet the fields in the fall. Water would not be applied to fields during the following winter because there would be little rice straw to decompose due to crop idling.

The difference in timing and quantity of water applied to the land may have the potential to alter the timing or concentration of associated leaching and runoff. Because more total water would be applied to fields under the Baseline Condition as compared to the Flexible Purchase Alternative, there would be more potential for leaching of salts and trace elements under the Baseline Condition. Additionally, application of fertilizers and pesticides associated with growing crops under the Baseline Condition would result in increased concentrations of nitrogen and phosphorus in surface water runoff as compared to the Flexible Purchase Alternative. Because there would be less total leaching potential under the Flexible Purchase Alternative as compared to the Baseline Condition, there would be no decrease in water quality due to timing and application of water to the land as a result of idling. In fact, there would potentially be an improvement in the quality of surface water runoff returning to rivers and lakes. Overall, the effect to water quality with respect to leaching and surface water runoff would therefore be less than significant.

5.2.5.2.2 Export Service Area

<u>Tulare Lake Subbasin</u>

EWA acquisition of water via crop idling of cotton in the Tulare Lake Subbasin would result in temporary conversion of lands from cotton crops to bare fields.

Under the Flexible Purchase Alternative, farmers would not plant cotton and no irrigation water would be supplied to the field. These barren fields would be dry and contain no cover, making them potentially susceptible to erosion from strong winds. In Fresno, Kern, Kings, and Tulare counties, the predominant soil texture classes of the surface layer include loamy sand, sandy loam, clay loam, silty clay, clay, and loam, which are classes that could be susceptible to wind erodibility. However, following harvest, farmers disc and plow under residual plant matter, such as cotton stalks, leaving the soil surface slightly furrowed. This practice would provide additional texture to the soil, reduce the surface area that is exposed, and increase the surface roughness. Depending on the soil texture type, idled cotton fields lose an estimated 48 to 134 tons soil/acre/year due to wind erosion under the worst cases. Because many variables affect a soil's erodibility index, and because the exact locations of the idled fields are not known, it is not possible to estimate a soil loss due to crop idling with more precision.

While crop idling would contribute to a substantial loss of topsoil under the Flexible Purchase Alternative as compared to the Baseline Condition, implementation of mitigation measures would reduce the potentially significant loss of topsoil to less than significant (see Chapter 8, Air Quality, Section 8.2.7, Mitigation Measures). With mitigation measures reducing the potentially significant loss of topsoil to less than significant, there would be a less than significant amount of fugitive dust that could be deposited onto surface waterbodies. As a result, there would be little to no decrease in the physiochemical qualities of surface water and adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality would not be expected. The effect to water quality would therefore be less than significant.

EWA acquisition of water via crop idling of cotton in the Tulare Lake Subbasin would alter the timing and quantity of water applied to the land.

Under the Baseline Condition, farmers would harvest their crop in late fall. Following harvest, cotton stalks would be plowed under, providing addition texture to the soil, reducing the surface area that is exposed, and increasing the surface roughness. Fields would be planted the following spring and irrigated throughout the summer. Harvest of the cotton crop would occur in late fall, thus completing the cotton crop cycle. Under the Flexible Purchase Alternative, after harvest in late fall, farmers would plow cotton stalks under, providing addition texture to the soil, reducing the surface area that is exposed, and increasing the surface roughness. With idling, crop lands would not be planted in the spring or irrigated in the summer. The soil would be expected to dry throughout the summer and would not become moist again until the winter rains begin in approximately November.

With respect to the timing and quantity of water applied to the land, the Baseline Condition and conditions under the Flexible Purchase Alternative differ in some regards. Under the Baseline Condition, fertilizers and pesticides are applied in the spring, and the land is irrigated throughout the summer. During the winter rains, beginning in November, fields would be wetted by rainfall. Aside from rainfall, no irrigation would be expected until planting in the following spring. Under the Flexible Purchase Alternative, cotton would not be planted in the spring, and fertilizers and pesticides would not be applied. Additionally, water would not be applied during the summer for irrigation. As in the Baseline Condition, rainfall beginning in November would serve to wet the fields throughout the rainy season.

The difference in timing and quantity of water applied to the land may have the potential to alter the timing or concentration of associated leaching and runoff. Because more total water would be applied to fields under the Baseline Condition as compared to the Flexible Purchase Alternative, there would be more potential for leaching of salts and trace elements under the Baseline Condition. Additionally, application of fertilizers and pesticides associated with growing crops under the Baseline Condition would result in increased concentrations of nitrogen and phosphorus in surface water runoff as compared to the Flexible Purchase Alternative. Because there would be less total leaching potential under the Flexible Purchase Alternative as compared to the Baseline Condition, there would be no decrease in water quality due to timing and application of water to the land as a result of idling. There would potentially be an improvement in the quality of surface water runoff returning to rivers and lakes. As a result, any differences in timing and application of water to the land would not be expected to affect water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. The effect to water quality with respect to leaching and surface water runoff would therefore be less than significant.

5.2.5.3 Stored Groundwater Purchase

EWA acquisition of water via stored groundwater purchase in the Export Service Area could result in direct conveyance of purchased stored groundwater to the California Aqueduct.

Because EWA acquisitions from stored groundwater purchase under the Flexible Purchase Alternative would not occur unless the water transfer conformed to the provisions set forth in the acceptance criteria for non-Project water (See Section 5.2.2), water quality in the California Aqueduct would not be adversely affected. In fact, water quality in the California Aqueduct may be improved with respect to bromide and organic carbon as a result of pumped-in groundwater, which typically has lower levels of these constituents than surface water in the California Aqueduct. As a result, EWA purchase of stored groundwater would not be expected to affect water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, it is expected that direct conveyance of purchased stored groundwater would result in a less than significant impact to water quality.

5.2.5.4 Groundwater Substitution

The potential effects to water quality associated with groundwater substitution in the Sacramento River, Feather River, Yuba River, American River, and Merced/San Joaquin River areas of analysis would not be expected to differ by basin. Therefore, the potential effects to water quality under the Flexible Purchase Alternative as compared to the Baseline Condition are evaluated for all areas of the Upstream from the Delta Region as a whole.

EWA acquisition of water via groundwater substitution in the Upstream from the Delta Region would result in substitution of groundwater for surface water typically applied to agricultural fields.

EWA acquisition of water via groundwater substitution under the Flexible Purchase Alternative would involve substitution of groundwater for surface water. Under the Flexible Purchase Alternative, groundwater would be pumped from wells and used to irrigate fields, allowing farmers to forego their surface water entitlements, which would be sold to the EWA. Groundwater would be applied to fields in lieu of surface water and would mix with surface water in agricultural drainages prior to irrigation return flow reaching the mainstem rivers. Under the Baseline Condition, some groundwater is currently used to supplement surface water entitlements in the Upstream from the Delta Region. However, the additional groundwater substitution that would be needed for implementation of the Flexible Purchase Alternative would not be required under the Baseline Condition, and surface water would be used to irrigate fields instead of substituted groundwater under the Baseline Condition.

The increase in the amount of groundwater substituted for surface water under the Flexible Purchase Alternative, as compared to the Baseline Condition, would be so small in comparison to the amount of surface water currently used to irrigate agricultural fields that the quality of the surface water, even after mixing with groundwater, would not be substantially decreased. Constituents of concern that may be present in the groundwater and subsequently input into surface water as a result of mixing with irrigation return flows, would be heavily diluted once in contact with the existing supply of surface water, given the high volume of surface water that is currently used for irrigation purposes.

Additionally, any acquisitions purchased by groundwater substitution under the EWA Program must adhere to the collaborative and systematic process set forth by DWR and Reclamation regarding obligatory transfer requirements between willing sellers and the purchasing agencies. This process has been established to ensure that potential effects to other legal users of water and third party effects are detected and that a local mitigation strategy has been developed prior to the groundwater transfer (see Chapter 6, Groundwater Mitigation Measures). As part of this process, the seller must recognize, assess and mitigate any adverse effects resulting from the transfer. Purchasing agencies also have a responsibility for assuring that the seller has an adequate mitigation program in place. To assist both parties of the transaction, a groundwater mitigation measure has been established to provide a framework with which to consider potential effects resulting from groundwater substitution (see Chapter 6). The groundwater mitigation measure includes: 1) a well review; 2) pre-purchase groundwater evaluation; 3) a monitoring program; and 4) a mitigation program. In addition to this environmental review, the groundwater mitigation measure set forth by the EWA Program provide further assurances that all potential adverse effects resulting from groundwater substitution are identified through a local monitoring program and locally mitigated (Chapter 6). Any associated mitigation measures and related funding shall be provided through local mitigation programs, which are tailored to the local conditions specific to each region.

In summary, the proportion of potential EWA-purchased groundwater that would be available for irrigation purposes using groundwater substitution under the Flexible Purchase Alternative, as compared to the total volume of surface water that is already in used on agricultural fields, would result in dilution of constituents of concern that may be input into surface water. Mixing of agricultural groundwater runoff with agricultural surface water runoff would result in sufficient dilution within the irrigation return flows, prior to draining into mainstem river reaches. Therefore, it is expected that groundwater substitution would result in a less than significant impact to water quality. Additionally, acquisitions via groundwater substitution under the Flexible Purchase Alternative would not occur unless the water transfer conformed to the provisions set forth in the groundwater mitigation measure.

5.2.5.5 Source Shifting

Borrowing water from San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake via source shifting would change the water surface elevations of these reservoirs.

Source shifting is a tool that was developed in the CALFED Record of Decision to help make the EWA Program more flexible. With source shifting, the EWA agencies borrow scheduled water from a project contractor for a fee, returning the water at a later date. The result of this option is to delay delivery of SWP or CVP contract water.

To participate in source shifting, contractors must have storage from which to draw while their deliveries are delayed. The EWA agencies could engage in source shifting agreements with Metropolitan WD or DWR, using several southern California reservoirs that deliver water to SWP contractors. Metropolitan WD is considering participation using surface water reservoirs (Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake) and groundwater storage programs. DWR may participate using its storage in Castaic Lake and Lake Perris. If source shifting were implemented in surface water storage facilities, it would cause the participating reservoir levels to fall earlier in the year than they would without the EWA, but the reservoir levels would level out and return to levels that would occur without the EWA as the water is paid back.

Under the Flexible Purchase Alternative, the EWA Program would take actions in the winter and spring, resulting in export reductions during that time period. Therefore, the amount of water that could have been pumped into San Luis Reservoir is less compared to the Baseline Condition. This results in lower storage in San Luis Reservoir under the Flexible Purchase Alternative as compared to the Baseline Condition. In order to prevent the storage in San Luis Reservoir from reaching the point at which deliveries can no longer be made or the point at which water quality creates a problem (300,000 AF) before it would have without the EWA Program due to EWA actions taken earlier in that year, the EWA agencies would activate a source shifting agreement. Source shifting is a shift in the timing of water deliveries from San Luis Reservoir. Source shifting participants reduce water deliveries from the SWP in comparison to the deliveries that would have occurred under the Baseline Condition in the early part of the summer resulting in less water being withdrawn from San Luis Reservoir, allowing San Luis Reservoir storage to remain above the point at which deliveries can no longer be made and to remain above 300,000 acre-feet for the same amount of time storage would have remained above 300,000 acre-feet under the Baseline Condition. During this time, source shifting participants rely on their own local resources in place of the water that would have been delivered from the SWP. After the San Luis Reservoir low point has occurred, the source shifting participants would be able to obtain the remaining water that was not delivered as a result of participating in source shifting. The discussion that follows addresses the water surface elevation reductions and potential effects that may be expected to occur in San Luis Reservoir, Castaic Lake, Lake Perris, and Diamond Valley Lake as a result of implementation of source shifting under the Flexible Purchase Alternative.

5.2.5.5.1 San Luis Reservoir

As described in Chapter 2, the objectives of source shifting are to prevent San Luis Reservoir from reaching the point where it cannot continue to make project deliveries (approximately 80,000 acre-feet) or where water quality creates problems for contractors (approximately 300,000 acre-feet) before it would have without the EWA Program. Under the Baseline Condition, water surface elevations in San Luis Reservoir would begin to decrease in mid-April and would continue to decrease until reservoir storage reached the low point for the year in late summer.

As detailed in Chapter 2, EWA acquisitions would not cause the reservoir to reach this target level more quickly, and would not reduce the reservoir level below 80,000 acre-feet, or below 300,000 acre-feet in years when reservoir levels would not have gone below this level under the Baseline Condition. If projections show that the EWA could cause San Luis Reservoir to reach 80,000 acre-feet or 300,000 acre-feet of storage sooner than it would have without the EWA, then the EWA agencies would implement source shifting agreements. In some years, San Luis Reservoir storage would fall below 300,000 acre-feet without the EWA Program. In this situation, the EWA agencies would not be responsible for source shifting to bring storage back up to 300,000 acre-feet, but would only need to shift sources to bring the storage back up to the without-EWA levels. Because source shifting would not result in a decrease in water surface elevation causing San Luis Reservoir to reach levels where it cannot continue to make project deliveries (80,000 acre-feet) or where water quality creates a problem for contractors (at approximately 300,000 acre-feet) sooner than it would have without implementation of the Flexible Purchase Alternative, alterations in water surface elevation resulting from implementation of the Flexible Purchase Alternative would not be expected to adversely affect designated beneficial uses, exceed existing regulatory standards, or substantially degrade water quality. As a result, the effect to water quality with respect to decreases in water surface elevation in San Luis Reservoir resulting from implementation of the Flexible Purchase Alternative would be less than significant.

5.2.5.5.2 Anderson Reservoir

Santa Clara Valley WD is considering two actions, pre-delivery and source shifting, involving the EWA Program. Pre-delivery actions would occur in the fall when EWA assets would be in risk of spill from San Luis Reservoir. EWA water assets would be transferred to Anderson Reservoir, only if Anderson Reservoir had available capacity under Anderson Reservoir's flood control operation rules (Anderson Reservoir needs to maintain flood control runoff capacity December through March of each year). The District may also use the EWA Program's ability to source shift assets based on conditions of San Luis Reservoir. If San Luis Reservoir were in risk of reaching low-point earlier than without EWA, the District would delay delivery of its project water supply later into the year to protect water quality of San Luis Reservoir. The District would only engage in source shifting if it could maintain its 20,000 acre-feet minimum storage amount and address in-stream flow requirements for Coyote Creek. Therefore, the effect to water quality with respect to decreases in water surface elevation in Anderson Reservoir resulting from implementation of the Flexible Purchase Alternative would be less than significant.

5.2.5.5.3 Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake

Source shifting under the EWA Flexible Purchase Alternative would result in a decrease in water surface elevations in Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake, as compared to the Baseline Condition. As the water is paid back, water levels would return to water surface elevations similar to those under the Baseline Condition. Source shifting would lower water surface elevations temporarily in these reservoirs, but only within existing operational parameters. In 2001, 50,000 acre-feet of source shifting occurred and Metropolitan WD used its flexible storage and drew replacement water from Castaic Lake during the source shift to meet demands (Hirsch 2003). During reductions in water surface elevations in Castaic Lake in 2001, there was no effect to water quality in the reservoir itself (Hirsch 2003). However, because of the heavy reliance on water from Castaic Lake, water treatment methods at the Jensen Treatment Plant needed to be altered (Hirsch 2003). The alterations to the Jensen Treatment Plant process included increasing the alum and chlorine feed rates in order to combat taste and odor problems (Hirsch 2003). This alteration resulted in Metropolitan WD incurring some additional costs at the water treatment plant, but this cost is factored into Metropolitan WD's participation in source shifting (Hirsch 2003), as described in Chapter 2. Water surface elevation reductions and heavy reliance on Castaic Lake water resulted in additional treatment costs, but because these costs are covered by factoring these costs into participation in source shifting, the use of Castaic Lake water for municipal water supply is protected. Therefore, the effect to water quality with respect to decreases in water surface elevation in Castaic Lake resulting from implementation of the Flexible Purchase Alternative would be less than significant.

Lake Perris and Diamond Valley Lake have not been used to participate in source shifting in the past (Hirsch 2003). Water surface elevation reductions in these two reservoirs are not likely to precipitate additional treatment requirements, such as those described above for Castaic Lake, because Metropolitan WD is able to avoid water quality concerns by blending SWP and Colorado River water at most water treatment plants (Hirsch 2003). Because Metropolitan WD can adjust the source water, the water surface elevation reductions in these reservoirs are not expected to necessitate increased water treatment costs (Hirsch 2003). However, if additional treatment was necessary, the fee for participation in source shifting would factor in additional treatment costs. Lake Perris specifically has water quality concerns regarding algae which are described in Section 5.1.5.3.4. As a result, it is unlikely that Lake Perris would be utilized in source shifting agreements (Hirsch 2003). Because blending of SWP and Colorado River water can be used to avoid water quality concerns regarding taste and odor associated with increased water surface elevation reductions and algal growth, the use of Lake Perris, Diamond Valley Lake, and Lake Mathews water for municipal water supply is protected. Therefore, the effect to water quality with respect to decreases in water surface elevation in Lake Perris, Diamond Valley Lake, and Lake Mathews resulting from implementation of the Flexible Purchase Alternative would be less than significant.

5.2.6 Environmental Consequences/Environmental Impacts of the Fixed Purchase Alternative

Extensive hydrologic modeling was performed for the Flexible Purchase Alternative to provide a quantitative basis from which to assess potential impacts of the Flexible Purchase Alternative within the EWA area of analysis. As discussed in Section 3.3, Framework for Environmental Consequences/Environmental Impact Analysis, the effects analysis for water quality does not depend on the location of a particular seller, but on the total amount of EWA water to be transferred via a particular tributary and receiving water body. Therefore, water quality effects were evaluated based on the largest amount of water that EWA agencies could manage for Delta actions (approximately 600,000 acre-feet), regardless of whether the specific water sellers could be identified at this time. The effect analysis with implementation of the Flexible Purchase Alternative represents a "worst case scenario" based on the maximum amount of water purchased by the EWA agencies. The impacts described in Section 5.2.5, Environmental Consequences/Environmental Impacts of the Flexible Purchase Alternative, represent the effects on water quality for this maximum transfer amount.

The Fixed Purchase Alternative would involve the same actions as the Flexible Purchase Alternative, but to a lesser degree. The Fixed Purchase Alternative specifies purchases of 35,000 acre-feet from the Upstream from the Delta Region, and 150,000 acre-feet from the Export Service Area. While the amounts in each region are fixed, the acquisition types and sources could vary. Potential impacts associated with implementation of the Fixed Purchase Alternative were analyzed on a qualitative basis, in relation to the hydrologic modeling results for the maximum amount of water that could be purchased under the Flexible Purchase Alternative.

5.2.6.1 Stored Reservoir Water (Including Stored Water Acquired from Crop Idling and Groundwater Substitution)

5.2.6.1.1 CVP/SWP Reservoirs Within the Upstream from the Delta Region

Lake Shasta, Lake Oroville, and Folsom Reservoir
EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution, and crop idling would alter surface water elevation and reservoir storage in Lake Shasta, relative to the Baseline Condition. EWA acquisition of Feather River contractor water via stored reservoir water, groundwater substitution, and crop idling would alter surface water elevations or reservoir storage in Lake Oroville, relative to the Baseline Condition. EWA acquisition of American River contractor water via stored reservoir water, groundwater substitution, and crop idling would alter surface water elevation and reservoir storage in Folsom Reservoir, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, Lake Shasta, Lake Oroville, and Folsom Reservoir end-of-month water surface elevations and reservoir storages would not be substantially less than end-of-month water surface elevations and reservoir storages under the Baseline Condition. Implementation of the Flexible Purchase Alternative would not be expected to adversely affect concentrations of water quality constituents in Lake Shasta, Lake Oroville, or Folsom Reservoir. As a result, changes in water surface elevation and reservoir storages would not be of sufficient magnitude and frequency to affect water quality in such a way that would result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality within Lake Shasta, Lake Oroville, and Folsom Reservoir with implementation of the Fixed Purchase Alternative are anticipated to be less than significant.

5.2.6.1.2 Non-Project Reservoirs Within the Upstream from the Delta Region

Little Grass Valley and Sly Creek Reservoirs
EWA acquisition of OWID stored reservoir water would reduce surface water elevation and reservoir storage in Little Grass Valley and Sly Creek reservoirs, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, median water surface elevation and median reservoir storage would decrease from November to April, relative to the Baseline Condition. Water temperatures during these months of the year would be at their lowest points during the annual cycle, and therefore the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into these reservoirs, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, changes in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect long-term water quality in such a way that would result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality within Little Grass Valley and Sly Creek reservoirs with implementation of the Fixed Purchase Alternative would be less than significant.

<u>New Bullards Bar Reservoir</u>
EWA acquisition of Yuba County Water Agency via stored reservoir water and groundwater substitution would alter surface water elevation and reservoir storage in New Bullards Bar Reservoir, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, median water surface elevation and median reservoir storage would decrease from July to January, but would increase from April through June, relative to the Baseline Condition. Water temperatures during the months of greatest reductions (September through December) would be low enough that the decrease in median reservoir storage and water surface elevation would not cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into this reservoir, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, changes in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality within New Bullards Bar Reservoir with implementation of the Fixed Purchase Alternative would be less than significant.

<u>French Meadows and Hell Hole Reservoirs</u>
EWA acquisition of Placer County Water Agency-stored reservoir water would decrease surface water elevation and reservoir storage in French Meadows and Hell Hole reservoirs, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, median water surface elevation and median reservoir storage would decrease from June to January in Hell Hole Reservoir and from July to January in French Meadows Reservoir, relative to the Baseline Condition. Water temperatures during the months of greatest reduction (September and October) would be low enough, given the percentage reduction in median reservoir storage, that the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into these reservoirs, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, changes in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality within French Meadows and Hell Hole reservoirs with implementation of the Fixed Purchase Alternative would be less than significant.

Lake McClure

EWA acquisition of Merced ID water via groundwater substitution would increase surface water elevation or reservoir storage in Lake McClure, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, median water surface elevation and median reservoir storage would increase from May to October and would remain essentially equivalent from June through September, relative to the Baseline Condition. Increases in median reservoir storage and median water surface elevation would benefit water quality by providing additional water for dilution of constituents and to buffer water temperature increases. As a result, increases in median water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality within Lake McClure with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.1.3 Rivers Within the Upstream from the Delta Region

Sacramento River

EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution, and crop idling would not substantially decrease Sacramento River flow, and would not substantially increase Sacramento River water temperature, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, Sacramento River flows at Keswick Dam and Freeport would be essentially equivalent to or greater than flows under the Baseline Condition. Increases in Sacramento River flows at Freeport during the summer months would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. Under the Flexible Purchase Alternative, water temperatures in the Sacramento River at Bend Bridge and Freeport would be essentially equivalent to or less than water temperatures under the Baseline Condition. As a result, changes in Sacramento River flows and water temperatures under the Flexible Purchase Alternative would not be of sufficient magnitude and frequency to result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be considered less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, flow- and water temperature-related impacts on water quality within the Sacramento River with implementation of the Fixed Purchase Alternative would be less than significant.

<u>Lower Feather River</u>

EWA acquisition of Feather River contractor water via stored reservoir water, groundwater substitution, and crop idling would not substantially decrease Feather River flow, and would not substantially increase Feather River water temperature, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, Feather River flow below the Thermalito Afterbay and at the mouth of the Feather River would be essentially equivalent to or greater than flows under the Baseline Condition. Increases in Feather River flow below Thermalito Afterbay and at the mouth during summer months would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. Under the Flexible Purchase Alternative, water temperatures in the Feather River below the Thermalito Afterbay and at the mouth of the Feather River would infrequently be increased by up to 0.7°F and would otherwise be essentially equivalent to or less than water temperatures under the Baseline Condition. As a result, changes in lower Feather River flows and water temperatures would not be of sufficient frequency and magnitude to result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be considered less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, flow- and water temperature-related impacts on water quality within the lower Feather River with implementation of the Fixed Purchase Alternative would be less than significant.

<u>Lower Yuba River</u>

EWA acquisition of lower Yuba River contractor water via stored reservoir water, groundwater substitution, and crop idling would alter lower Yuba River flow and water temperature, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, lower Yuba River flows would be greater than the flows under the Baseline Condition, based on data from previous water transfers. Increases in lower Yuba River flows would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. In addition, lower Yuba River water temperatures would be less than the water temperatures under the Baseline Condition, based on data from previous water transfers. As a result, changes in lower Yuba River flows and water temperatures would not be of sufficient frequency and magnitude to result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, flow- and water temperature-related impacts on water quality within the lower Yuba River with implementation of the Fixed Purchase Alternative would be less than significant.

<u>Middle Fork American River</u>

EWA acquisition of American River contractor water via stored reservoir water and crop idling would alter Middle Fork American River flow, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, Middle Fork American River median flows below Ralston Afterbay would be essentially equivalent to or great than flows under the Baseline Condition, in nine months of the year. Median flow in the Middle Fork American River would decrease in November, January, and February under the Flexible Purchase Alternative as compared to the Baseline Condition. Increases in Middle Fork American River flows below Ralston Afterbay in June, July, August, and September would allow dilution of water quality constituents. Decreased flows during the months of greatest flow reduction (November and February) would not be expected to cause an increase in concentration of water quality constituents that would result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality because the water quality in the Middle Fork American River is of high quality and concentrations of constituents are generally low. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, flow-related impacts on water quality within the Middle Fork American River with implementation of the Fixed Purchase Alternative would be less than significant.

<u>Lower American River</u>

EWA acquisition of stored groundwater from Sacramento Groundwater Authority members, stored reservoir water, and water obtained through Placer Country Water Agency crop idling and retained in Folsom Reservoir under the Flexible Purchase Alternative would increase lower American River flow, and would not substantially increase American River water temperature, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, long-term average lower American River flows below Nimbus Dam, at Watt Avenue, and at the mouth of the American River would be essentially equivalent to or greater than flows under the Baseline Condition. Increases in lower American River flows at all three locations during July and August and during September would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. Water temperature in the American River below Nimbus Dam, at Watt Avenue, and at the mouth of the American River under the Flexible Purchase Alternative would infrequently increase by up to 1.0°F and would otherwise be essentially equivalent to or less than water temperatures under the Baseline Condition. As a result, changes in lower American River flows and water temperatures would not be of sufficient frequency and magnitude to result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, flow- and water temperature-related impacts on water quality within the lower American River with implementation of the Fixed Purchase Alternative would be less than significant.

<u>Merced River</u>
EWA acquisition of Merced River contractor water via groundwater substitution would increase Merced River flow, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, Merced River flows below Crocker-Huffman Dam and at the mouth of the Merced River would be essentially equivalent to or greater than flows under the Baseline Condition. Increases in Merced River flows at Crocker-Huffman Dam and at the mouth of the Merced River during October and November would allow dilution of water quality constituents. As a result, changes in Merced River flows would not be of sufficient frequency and magnitude to result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, flow-related impacts on water quality within the Merced River with implementation of the Fixed Purchase Alternative would be less than significant.

<u>San Joaquin River</u>
EWA acquisition of Merced River contractor water via groundwater substitution would increase San Joaquin River flow, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, San Joaquin River flows below the confluence with the Merced River and at Vernalis would be essentially equivalent to or greater than flows under the Baseline Condition. Increases in San Joaquin River flows at both locations during October and November would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, changes in San Joaquin River flows would not be of sufficient frequency and magnitude to result in long-term adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, flow-related impacts on water quality within the San Joaquin River with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.1.4 Sacramento-San Joaquin Delta Region

EWA acquisition of water would alter the timing of CVP/SWP exports from the Delta, relative to the Baseline Condition.

Under both Flexible Purchase Alternative and the Fixed Purchase Alternative, carriage water would be used to protect water quality and maintain chloride standards in the Delta during the period when water is purchased and moved from the Upstream from the Delta Region. Carriage water is an increase in Delta outflow that maintains chloride and bromide concentrations at levels that would be equivalent to those under the Baseline Condition. Under the Flexible Purchase Alternative, potential increases in chloride and bromide concentrations in the Delta due to increased SWP and CVP pumping of EWA water during the summer months would not occur because of the utilization of carriage water to ensure no significant changes in Delta water quality during the periods of increased pumping. Sufficient carriage water would be purchased by EWA for use in maintaining the quality of water supplied to CVP and SWP water users, therefore the quality of water supplied to downstream and in-Delta users would be equivalent during periods EWA water is being pumped at the CVP and SWP pumping plants under the Flexible Purchase Alternative and under the Baseline Condition. Additionally, because organic carbon concentration in the Sacramento River are typically lower in the summer months when increased pumping would occur, increased pumping would not result in increased organic carbon in the Delta. In addition, in all but the driest years, EWA actions taken during the winter/spring months (decreased pumping) would result in increased Delta outflow. Increased Delta outflow would result in beneficial impacts on water quality within the Delta. As a result, water quality, including salinity, bromide, total organic carbon, and the potential for THM and bromate formation, would not be altered in a way that would result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, overall potential effects on water quality within the Delta related to salinity, bromide, organic carbon, THM formation potential, and the potential for bromate formation with implementation of the Fixed Purchase Alternative would be less than significant.

EWA acquisition of water would alter the timing of CVP/SWP exports to downstream municipal users, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, modeling results illustrate that EWA actions would not increase the total salts (total chloride and bromide loading) pumped at the SWP and CVP pumping plants to CVP and SWP water users. Additionally, under the Flexible Purchase Alternative, by decreasing pumping when carbon concentrations are highest and increasing pumping when carbon concentration are lowest, organic carbon concentrations in water supplied to in-Delta water users and CVP and SWP users would be expected to, at a minimum, remain equivalent to the carbon concentrations that would have occurred in the absence of the EWA Program. As a result, water quality constituents, including salinity, bromide, and organic carbon, and the potential for THM and bromate formation, would not be altered in such a way that would result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, overall potential effects on water quality within the Delta related to salinity, bromide, organic carbon, THM formation potential, and the potential for bromate formation with implementation of the Fixed Purchase Alternative would be less than significant

5.2.6.2 Crop Idling

5.2.6.2.1 Upstream from the Delta Region

EWA acquisition of water via crop idling of rice in the Sacramento Valley would result in temporary conversion of lands from rice crops to bare fields.

Under the Flexible Purchase Alternative, there would be little to no increase in sediment transport resulting from wind erosion or winter runoff from idled fields. As a result, there would be little to no decrease in the physiochemical qualities of surface water and adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality would not be expected. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality due to crop idling with implementation of the Fixed Purchase Alternative would be less than significant.

EWA acquisition of water via crop idling of rice in the Sacramento Valley would alter the timing and quantity of water applied to the land.

Under the Flexible Purchase Alternative, less total water would be applied to fields than under the Baseline Condition, therefore there would be less potential for leaching of salts and trace elements than under the Baseline Condition. Additionally, application of fertilizers and pesticides associated with growing crops under the

Flexible Purchase Alternative would result in decreased concentrations of nitrogen and phosphorus in surface water runoff, relative to the Baseline Condition. Because there would be less total leaching potential under the Flexible Purchase Alternative relative to the Baseline Condition, there would be no decrease in water quality due to timing and application of water to the land as a result of idling. In fact, there would potentially be an improvement in the quality of surface water runoff returning to rivers and lakes. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality due to crop idling with respect to leaching and surface water runoff with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.2.2 Export Service Area

Tulare Lake Subbasin

EWA acquisition of water via crop idling of cotton in the Tulare Lake Subbasin would result in temporary conversion of lands from cotton crops to bare fields.

While crop idling would contribute to a substantial loss of topsoil under the Flexible Purchase Alternative relative to the Baseline Condition, implementation of air quality mitigation measures would reduce the potentially significant loss of topsoil to less than significant (see Chapter 8, Air Quality, Section 8.2.8, Mitigation Measures). With air quality mitigation measures reducing the potentially significant loss of topsoil to less than significant, there would be a less than significant amount of fugitive dust that could be deposited onto surface waterbodies. As a result, there would be little to no decrease in the physiochemical qualities of surface water and adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality would not be expected. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality due to crop idling within the Tulare Lake Subbasin with implementation of the Fixed Purchase Alternative would be less than significant.

EWA acquisition of water via crop idling of cotton in the Tulare Lake Subbasin would alter the timing and quantity of water applied to the land.

Under the Flexible Purchase Alternative, less total water would be applied to fields, relative to the Baseline Condition, therefore there would be less potential for leaching of salts and trace elements. Additionally, decreased application of fertilizers and pesticides associated with growing crops under the Flexible Purchase Alternative would result in decreased concentrations of nitrogen and phosphorus in surface water runoff, relative to the Baseline Condition. There would be less total leaching potential under the Flexible Purchase Alternative, relative to the Baseline Condition, therefore adverse impacts on water quality due to changes in the timing and application of water to the land as a result of idling are not anticipated. There would potentially be an improvement in the quality of surface water runoff returning to rivers and lakes. As a result, changes in the timing and quantity of water applied to the land would not be expected to result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality due to crop idling with respect to leaching and surface water runoff within the Tulare Lake Subbasin with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.3 Stored Groundwater Purchase

EWA acquisition of water via stored groundwater purchase in the Export Service Area could result in direct conveyance of purchased stored groundwater to the California Aqueduct.

Under the Flexible Purchase Alternative, EWA acquisitions from stored groundwater purchase would not occur unless the water transfer conformed to the provisions set forth in the acceptance criteria for non-Project water, therefore water quality in the California Aqueduct would not be adversely affected. In fact, water quality in the California Aqueduct may be improved with respect to bromide and organic carbon as a result of pumped-in groundwater, which typically has lower levels of these constituents than surface water in the California Aqueduct. As a result, EWA purchase of stored groundwater would not be expected to affect water quality in such as way that would result in adverse effects on designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality due to direct conveyance of purchased stored groundwater with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.4 Groundwater Substitution

EWA acquisition of water via groundwater substitution in the Upstream from the Delta Region would result in substitution of groundwater for surface water typically applied to agricultural fields.

Under the Flexible Purchase Alternative, the proportion of potential EWA-purchased groundwater that would be available for irrigation purposes using groundwater substitution, compared to the total volume of surface water that is already in used on agricultural fields, would result in dilution of constituents of concern that may be input into surface water. Mixing of agricultural groundwater runoff with agricultural surface water runoff would result in sufficient dilution within the irrigation return flows, prior to draining into mainstem river reaches. Additionally, acquisitions from groundwater substitution would not occur unless the water transfer conformed to the provisions set forth in the groundwater mitigation measure, and, therefore any potential effects to water quality would be less than significant. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality due to groundwater substitution with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.5 Source Shifting

Borrowing water from San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake via source shifting would change the water surface elevations of these reservoirs.

5.2.6.5.1 San Luis Reservoir

Under the Flexible Purchase Alternative, source shifting would not result in a decrease in water surface elevation causing San Luis Reservoir to reach levels where it cannot continue to make project deliveries (80,000 acre-feet) or where water quality creates a problem for contractors (at approximately 300,000 acre-feet) sooner than it would have without implementation of the Flexible Purchase Alternative. Therefore, alterations in water surface elevations resulting from implementation of the Flexible Purchase Alternative would not be expected to adversely affect designated beneficial uses, exceed existing regulatory standards, or substantially degrade water quality. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality with respect to decreases in San Luis Reservoir water surface elevations with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.5.2 Anderson Reservoir

Under the Flexible Purchase Alternative, the Santa Clara Valley WD would only engage in source shifting if it could maintain its 20,000 acre-feet minimum storage amount and address in-stream flow requirements for Coyote Creek. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality with respect to decreased Anderson Reservoir water surface elevations with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.6.5.3 Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake

Under the Flexible Purchase Alternative, the effect on water quality with respect to decreases Castaic Lake water surface elevations resulting from implementation of the Flexible Purchase Alternative would be less than significant. Blending of SWP and Colorado River water can be used to avoid water quality concerns regarding taste and odor associated with decreased water surface elevations and algal growth, therefore the use of Lake Perris, Diamond Valley Lake, and Lake Mathews water for municipal water supply is protected. No significant impacts on water quality under the Flexible Purchase Alternative were identified. Impacts considered less than significant under the Flexible Purchase Alternative also would be less than significant for an equal or lesser transfer amount (the Fixed Purchase Alternative). Therefore, impacts on water quality with respect to decreased Castaic Lake, Lake Perris, Lake Mathews, and Diamond Valley Lake water surface elevations and algal growth with implementation of the Fixed Purchase Alternative would be less than significant.

5.2.7 Comparative Analysis of Alternatives

This chapter has thus far analyzed the effects of many potential transfers, looking at the "worst-case scenario" that would occur if all acquisitions happened in the same year. This approach ensures that all effects of transfers are included and provides the EWA Project Agencies the flexibility to choose transfers that may be preferable in a given year. The EWA, however, would not actually purchase all of this water in the same year. This section provides information about how EWA would more likely operate in different year types.

Under the No Project/No Action Alternative, increased precipitation during wet years would dilute water quality constituents in reservoirs and rivers. Additional water would also increase Delta inflows, reducing constituent levels. Dry years would produce limited inflow to the Delta, worsening water quality. Dry years would also result in reservoir constituent levels to increase.

In the Upstream from the Delta Region, the Fixed Purchase Alternative would be limited to a maximum acquisition of 35,000 acre-feet from all sources of water. In most years, this amount could be obtained from stored reservoir water purchases. This amount of water would not cause significant water quality impacts within the Delta due to changes in timing of flows.

The Flexible Purchase Alternative could involve the purchase of up to 600,000 acre-feet of water from all sources upstream from the Delta. EWA agencies would prefer to purchase water from upstream sources because the water is generally less expensive. The amount that could be purchased would be limited by the excess capacity of the Delta export pumps to move the water to the Export Service Area. During wet years, excess pump capacity may be limited to as little as 50,000 to 60,000 acre-feet of EWA asset water because the pumps primarily would be used to export Project water to Export Service Area users. Effects during wet years would therefore be close to those described under the Fixed Purchase Alternative. During dry years, when there would be less Project water available for pumping (and therefore the pumps would have greater availability capacity), the EWA Project Agencies could acquire up to 600,000 acre-feet of water from sources upstream from the Delta. The Flexible Purchase Alternative effects on the Delta would vary depending on the water-year type, with more effects during wet years when more water is moved through the Delta.

EWA asset acquisitions in the Export Service Area under the Fixed Purchase Alternative would be limited to 150,000 acre-feet from stored groundwater and crop idling sources. Kern County Water Agency would provide the stored groundwater, and the water quality would need to be coordinated with SWP operators.

EWA asset acquisitions in the Export Service Area under the Flexible Purchase Alternative would be dependent on the water year type north of the Delta. Export pump capacity during wet years would limit the ability of the EWA Project Agencies to move assets through the Delta, requiring reliance on greater purchase amounts from export area sources. During wet years, acquisitions within the Export Service Area could involve up to 600,000 acre-feet of assets. The EWA agencies would acquire assets from stored groundwater and idled cropland sources. The EWA agencies would acquire less water from the Export Service Area during dry years, when most of the assets needed could be moved through the Delta. Moving stored groundwater into the California Aqueduct, therefore, would be less of a concern during dry years. Table 5-77 summarizes and compares the potential effects and level of significance relative to water quality with implementation of the EWA Program under both the Flexible Purchase and Fixed Price Alternatives.

Table 5-77
Water Quality
Summary and Comparison of Flexible Purchase Alternative and Fixed Purchase Alternative Effects

Area of Analysis	Asset Acquisition or Management Type	Result	Potential Effects	Flexible Alternative Effects Compared to Baseline Condition	Fixed Alternative Effects Compared to Baseline Condition	Significance of Flexible Purchase Alternative	Significance of Fixed Purchase Alternative
Upstream from the Delta Region							
Sacramento River	Groundwater Substitution/Crop Idling	Seasonal changes in timing of releases from Lake Shasta.	Alteration of surface water elevation and storage in Lake Shasta to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Maximum decrease of 19,000 acre-feet reservoir storage and one foot water surface elevation in July compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
			Alteration of Sacramento River flows and water temperatures to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Maximum flow decrease of 58 cfs in August and no change in temperature in the Sacramento River compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
	Crop Idling	Conversion of rice crop to bare fields.	Changes in sediment transport via wind erosion and runoff to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Increases in sediment transport due to wind erosion, resulting in sediment deposition in surrounding waterbodies compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
		Water not applied to fields in summer for irrigation.	Alteration in timing and quantity of water applied to the land to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Decreases in the physiochemical qualities of surface water compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.

Table 5-77
Water Quality
Summary and Comparison of Flexible Purchase Alternative and Fixed Purchase Alternative Effects

Area of Analysis	Asset Acquisition or Management Type	Result	Potential Effects	Flexible Alternative Effects Compared to Baseline Condition	Fixed Alternative Effects Compared to Baseline Condition	Significance of Flexible Purchase Alternative	Significance of Fixed Purchase Alternative
	Groundwater substitution	Groundwater applied to agricultural fields.	Alteration in quality of surface water following mixing of groundwater and surface water to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Deteriorations of the physiochemical qualities of surface runoff compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
Feather River	Stored Reservoir Water	Seasonal changes in timing of releases from Sly Creek and Little Grass Valley Reservoirs.	Alteration of Sly Creek and Little Grass Valley Reservoirs water surface elevation and storage to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	In Sly Creek Reservoir, maximum decrease of 5,000 acre-feet in reservoir storage and 18 feet elevation in December. In Little Grass Valley, maximum decrease of 12,000 acre-feet in reservoir storage and 12 feet elevation in December compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
	Stored Reservoir Water/Groundwater Substitution/ Crop Idling	Seasonal changes in timing of releases from Lake Oroville.	Alteration of surface water elevation and storage in Lake Oroville to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Maximum decrease of 50,000 acre-feet reservoir storage and 4 feet water surface elevation in July compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
			Alteration of Feather River flows and water temperatures to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	No change in flow and a maximum increase of 0.2˚F in temperature in the Feather River compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.

**Table 5-77
Water Quality
Summary and Comparison of Flexible Purchase Alternative and Fixed Purchase Alternative Effects**

Area of Analysis	Asset Acquisition or Management Type	Result	Potential Effects	Flexible Alternative Effects Compared to Baseline Condition	Fixed Alternative Effects Compared to Baseline Condition	Significance of Flexible Purchase Alternative	Significance of Fixed Purchase Alternative
	Crop Idling	Conversion of rice crops to bare fields.	Changes in sediment transport via wind erosion and runoff to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Increases in sediment transport due to wind erosion, resulting in sediment deposition in surrounding waterbodies compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
		Water not applied to fields in summer for irrigation.	Alteration in timing and quantity of water applied to the land to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Decreases in the physiochemical qualities of surface water compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
	Groundwater substitution	Groundwater applied to agricultural fields.	Alteration in quality of surface water following mixing of groundwater and surface water to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Deteriorations of the physiochemical qualities of surface runoff compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
Yuba River	Stored Reservoir Water/ Groundwater Substitution	Seasonal changes in timing of releases from New Bullards Bar Reservoir.	Alteration of Yuba River flows and water temperatures to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Lower Yuba River flows would increase and temperatures would decrease compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
			Alteration of surface water elevation and storage in New Bullards Bar Reservoir to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Maximum decrease of 18,000 acre-feet reservoir storage and 27 feet water surface elevation in October compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.

Table 5-77
Water Quality
Summary and Comparison of Flexible Purchase Alternative and Fixed Purchase Alternative Effects

Area of Analysis	Asset Acquisition or Management Type	Result	Potential Effects	Flexible Alternative Effects Compared to Baseline Condition	Fixed Alternative Effects Compared to Baseline Condition	Significance of Flexible Purchase Alternative	Significance of Fixed Purchase Alternative
	Groundwater substitution	Groundwater applied to agricultural fields.	Alteration in quality of surface water following mixing of groundwater and surface water to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Deteriorations of the physiochemical qualities of surface runoff compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
American River	Stored Reservoir Water/ Crop Idling/ Groundwater Substitution	Seasonal changes in timing of releases from French Meadows and Hell Hole reservoirs.	Alteration of surface water elevation and storage in French Meadows and Hell Hole reservoirs to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	In French Meadows Reservoir, maximum decrease of 8,000 acre-feet in reservoir storage and 8 feet elevation in October. In Hell Hole Reservoir, maximum decrease of 12,000 acre-feet in reservoir storage and 15 feet elevation in September and October compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
			Alteration of Middle Fork American River flows to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Maximum flow decrease of 213 cfs in November in the Middle Fork American River compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
		Seasonal changes in timing of releases from Folsom Reservoir.	Alteration of surface water elevation and storage in Folsom Reservoir to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Maximum decrease of 4,000 acre-feet reservoir storage and one foot water surface elevation in July compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
			Alteration of lower American River flows and water temperatures to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	No flow decreases and a maximum temperature increase in September in the Lower American River compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.

Table 5-77
Water Quality
Summary and Comparison of Flexible Purchase Alternative and Fixed Purchase Alternative Effects

Area of Analysis	Asset Acquisition or Management Type	Result	Potential Effects	Flexible Alternative Effects Compared to Baseline Condition	Fixed Alternative Effects Compared to Baseline Condition	Significance of Flexible Purchase Alternative	Significance of Fixed Purchase Alternative
	Crop Idling	Conversion of rice crops to bare fields.	Changes in sediment transport via wind erosion and runoff to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Increases in sediment transport due to wind erosion, resulting in sediment deposition in surrounding waterbodies compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
		Water not applied to fields in summer for irrigation.	Alteration in timing and quantity of water applied to the land to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Decreases in the physiochemical qualities of surface water compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
	Groundwater substitution	Groundwater applied to agricultural fields.	Alteration in quality of surface water following mixing of groundwater and surface water to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Deteriorations of the physiochemical qualities of surface runoff compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
Merced and San Joaquin Rivers	Groundwater Substitution	Seasonal changes in timing of releases from Lake McClure.	Alteration of surface water elevation and storage in Lake McClure to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Decreases in reservoir storage and water surface elevation would not occur compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
			Alteration of Merced River or San Joaquin River flows to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	No flow decreases in the Merced and San Joaquin Rivers compared to the Baseline Condiiton.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.

Table 5-77
Water Quality
Summary and Comparison of Flexible Purchase Alternative and Fixed Purchase Alternative Effects

Area of Analysis	Asset Acquisition or Management Type	Result	Potential Effects	Flexible Alternative Effects Compared to Baseline Condition	Fixed Alternative Effects Compared to Baseline Condition	Significance of Flexible Purchase Alternative	Significance of Fixed Purchase Alternative
		Groundwater applied to agricultural fields.	Alteration in quality of surface water following mixing of groundwater and surface water to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Deteriorations of the physiochemical qualities of surface runoff compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
Sacramento-San Joaquin Delta Region							
Sacramento-San Joaquin Delta	Crop Idling, Groundwater Substitution, Stored Groundwater Purchase, Stored Reservoir Water Purchase	Increased pumping from July through September.	Alterations in chloride, bromide, or organic carbon concentrations in the Delta during months of increased pumping to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Use of carriage water would maintain or reduce the chloride, bromide, or organic carbon concentrations in the Delta.	Use of carriage water would maintain or reduce the chloride, bromide, or organic carbon concentrations in the Delta.	Less-than-significant impact.	Less-than-significant impact.
		Shifting in timing of export pumping.	Alterations in the annual total salt and organic carbon load delivered to CVP and SWP water users to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Total chloride loading would decrease 1.7 percent and total bromide loading would decrease 1.7 percent compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
Export Service Area							
Export Service Area	Crop idling	Conversion of cotton crop to bare fields.	Change in the amount of runoff of salinity and trace elements into nearby waterbodies to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Increases in sediment transport due to wind erosion, resulting in sediment deposition in surrounding waterbodies compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.

Table 5-77
Water Quality
Summary and Comparison of Flexible Purchase Alternative and Fixed Purchase Alternative Effects

Area of Analysis	Asset Acquisition or Management Type	Result	Potential Effects	Flexible Alternative Effects Compared to Baseline Condition	Fixed Alternative Effects Compared to Baseline Condition	Significance of Flexible Purchase Alternative	Significance of Fixed Purchase Alternative
		Water not applied to fields in summer for irrigation.	Alteration in timing and quantity of water applied to the land to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Decreases in the physiochemical qualities of surface water compared to the Baseline Condition.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.
	Stored Groundwater Purchase	Conveyance of stored groundwater directly into the California Aqueduct.	Exceedance of non-Project water acceptance criteria to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Purchased groundwater would adhere to the standards set forth in the acceptance criteria for non-Project water.	Purchased groundwater would adhere to the standards set forth in the acceptance criteria for non-Project water.	Less-than-significant impact.	Less-than-significant impact.
	Source Shifting	Seasonal changes in timing of releases from San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Lake Mathews, or Diamond Valley Lake.	Alteration of water surface elevations in San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Lake Mathews, or Diamond Valley Lake to result in long-term adverse effects on designated beneficial uses, exceedances of existing regulatory standards, or substantial degradation of water quality.	Changes in water surface elevation would be within existing operational parameters.	Effects would be equal to or less than effects under the Flexible Purchase Alternative.	Less-than-significant impact.	Less-than-significant impact.

5.2.8 Mitigation Measures

Under each of the acquisition types identified for the EWA Program, no adverse effects would occur to water quality resources. For EWA acquisitions obtained through groundwater substitution, the groundwater mitigation measure described in Chapter 6 (Groundwater Resources), provides assurances that local monitoring and mitigation programs are developed prior to an EWA acquisition via groundwater substitution. For EWA acquisitions obtained through crop idling, the air quality mitigation measure described in Chapter 8 provides assurances that the loss of topsoil resulting from idling lands is less than significant. Consequently, the EWA Program does not require mitigation measures to avoid, reduce, or eliminate adverse impacts on water quality.

5.2.9 Potentially Significant Unavoidable Impacts

There are no potentially significant unavoidable impacts to water quality associated with the implementation of the EWA Program.

5.2.10 Cumulative Effects

The analysis of potential EWA effects to water quality resources within the area of analysis compared the Flexible Purchase Alternative to the Baseline Condition. Historical data for reservoir storage volumes and water surface elevations, and river flows were used as a baseline for the comparative analysis. The analysis evaluated the effects to rivers and reservoirs as a percent change in flow and reservoir storage and water surface elevation. If additional transfer programs draw reservoirs down or reduce river flows below the acceptable criteria for water quality management, the effects could be cumulatively significant.

Upstream from the Delta, all five programs (Sacramento Valley Water Management Agreement, Dry Year Purchase Program, Critical Water Shortage Contingency Plan, Central Valley Project Improvement Act [CVPIA] Water Acquisition Program, and Environmental Water Program) have the potential to acquire water via stored reservoir water during dry years. If these programs use the same reservoirs as the EWA, water surface elevations and end-of-month storage levels could drop further, resulting in potentially significant effects to water quality, such as an increase in concentrations of constituents. In order to prevent cumulatively significant impacts, water agencies would have to cooperatively set release limits on reservoirs such that the reservoirs would not be drawn down below the levels required to maintain suitable water quality levels within the reservoirs, especially during the summer season, when water levels are already low within the reservoirs.

Actions such as groundwater substitution and crop idling upstream from the Delta would potentially occur in all cumulative programs. Transfers negotiated between CVP and SWP contractors and other water users, such as the Forbearance Agreement with Westlands Water District and the recent crop idling acquisition by Metropolitan WD from water agencies upstream from the Delta, are considered part of the Dry Year Program. These actions, in addition to EWA, would further reduce river flow during the summer and further increase flow in the fall. The decrease could be cumulatively significant if it were to further reduce flow, such that water quality (e.g., concentration of constituents of concern, water temperature) would be affected adversely. However, potential increases in flow late in the season could be cumulatively beneficial to the water quality (e.g., dilution of constituents). Overall, flow rates would most likely be governed by established regulatory requirements for anadromous and riverine fish, through such agencies as USFWS and National Oceanic and Atmospheric Administration Fisheries, which would prevent flow rates from increasing or decreasing in a manner that would be harmful to the fisheries. The fluctuations in flow caused by the cumulative actions would most likely not increase or decrease flows with sufficient magnitude or frequency to cause a cumulatively significant impact to water quality.

With regard to cumulative effects to water quality in the Sacramento-San Joaquin Delta Region, the analysis of the maximum amount of water that can be exported from the Delta provides an evaluation of the potential cumulative environmental effects of EWA water purchases and all other water transfers through the Delta. As described in detail in Attachment 1, for the EWA Program, the cumulative impact assessment comparison is the same as the impact assessment termed "Flexible Purchase Alternative Compared to the Baseline Condition" because, with regard to modeling results, the Environmental Setting is not differentiated from the Baseline Condition, and the cumulative simulation is not differentiated from the Flexible Purchase Alternative simulation. As described in Section 5.2.1.1.3, as a result of assuming utilization of all of the unused CVP and SWP pumping capacity for EWA, all potential SWP and CVP uses were analyzed. As a result, the analysis presented in Section 5.2.5.1.4 is not only an evaluation of the Flexible Purchase Alternative as compared to the Baseline Condition, but is also an evaluation of the Cumulative condition as compared to the Environmental Setting/No Action/No Project condition.

Only the Critical Water Shortage Contingency Plan and the CVPIA Water Acquisition Program operate in the Export Service Area. EWA acquisitions via crop idling and groundwater substitution would not affect the water quality adversely. Water acquired through crop idling and groundwater substitution would be held in the reservoirs and the additional water may provide opportunities for additional dilution of constituents. Water acquisition through these means, in conjunction with EWA, is not expected to have a cumulatively significant impact to water quality.

Asset management through source shifting in the Export Service Area would not likely cause a significant impact under the cumulative condition. Water storage in Anderson Reservoir would not go below 20,000 acre-feet regardless of the amount of potential water transfers under each acquisition program. Additionally, Metropolitan WD would manage its reservoirs within normal operating parameters for water transfers under all programs. Water levels in Castaic Lake and Lake Perris would not lower below the Baseline Condition. Diamond Valley Lake recently filled; therefore, there is no historical basis of comparison for effects. Consequently, cumulative effects to water quality would be less than significant.

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